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INDO-PACIFIC FISHERIES COUNCIL

THE work of the International Council for the Exploration of the Sea established at Copenhagen, Denmark, in 1899, for starting and co-ordinating detailed programmes of research and investigations on multifarious hydrological and biological problems in the waters of the Arctic Ocean and the North and Baltic Seas by nations interested in the fisheries of this vast area, not only proved the value of such international co-operative work, but also evolved the pattern for carrying out such developmental projects on a regional basis not circumscribed by artificial national boundaries. The Fisheries Committee of the F.A.O. in its first two sessions at Quebec and Copenhagen in 1945 and 1946 considered in detail the questions connected with the development of the fishery resources of under-developed areas, such as, South East Asia, Southern Pacific, etc. Definite plans for starting Regional Fisheries Councils for such areas were formulated in the meeting of the U.N.R.R.A. workers in Australia in 1946 and in the Fisheries Meeting held at Singapore in January 1947 under the ægis of the Special Commissioner for South East Asia. As a result, an Agreement was drawn up by the Governments of Burma, China, France, India, the Netherlands, the Philippines, the United Kingdom and the United States of America in a meeting convened by F.A.O. at Baguio in Philippines in February 1948 for the establishment of an Indo-Pacific Fisheries Council, which would co-ordinate and plan programmes for the development and proper

utilization of the aquatic resources of the Indo-Pacific area. In accordance with the terms of the Agreement, the Indo-Pacific Fisheries Council came into existence in November 1948, when information regarding ratification of the Agreement by five of the member nations was received by the Director-General of the F.A.O. Since then the Agreement has been accepted by seven more Governments.

The first session of this Council was inaugurated by the Hon'ble Mr. Norris E. Dodd, Director-General of the F.A.O., at Singapore, on the 24th of March 1949, and the session continued till 31st of March. In this inaugural session the main work of the Council consisted in establishing the basis of a programme of international collaboration in connection with research and exploration of the aquatic resources of this vast area. The session was attended by delegates of 9 member countries, *viz.*, Australia, Ceylon, China, French Indo-China, India, the Netherlands, the Philippines, the United Kingdom and the United States of America, while official observers on behalf of Korea, UNESCO, SCAP and Southern Pacific Commission also attended the meetings.

Active work in connection with the organization of the Council had been carried on since the Fisheries Meeting in Singapore in January 1947; information and views had been exchanged between various countries; some data had been collected; papers prepared; and a number of informal meetings held. All this work had built up an understanding of the ways in which international collaboration would be useful and where it would be possible. All the same, the delegates came with open minds and often with very varying ideas. Although the Baguio Agreement had provided the main lines of the plan of organization for the Council, it was found necessary to discuss this plan in great detail, and to lay down the Rules of Procedure for the Council. This work, which was completed at the inaugural meeting, may be regarded as one of the principal results of the meeting. It is proposed to hold regularly an annual meeting of the Council at a place to be decided on by the Council, but special meetings to be called either at the direction of the Council, or of the Executive Committee with the approval of a majority of the member governments or at the request of a majority of the member government themselves are also provided under the Rules. In between the annual sessions, the work of the Council will be carried on by an Executive Committee consisting of a Chairman, a Vice-Chairman, and the Secretary. The Secretary is the F.A.O. Regional Representative for Fisheries in the Far East, and the necessary finance and secretariat assistance is being provided by the F.A.O. For carrying out the technical work of the Council, two Technical Committees with well-defined terms of reference relating to specific problems in Biology and Hydrology on the one hand and Technology of the craft and gear, efficient distribution of catches and the economics of the industry on the other have been set up. These Committees met a number of times and drew up a number of realistic programmes of work. This will be clear from the terms of reference of the two Committees as outlined below:—

1. The Committee on Hydrology and Biology will deal with specific problems of the development and proper utilization of the fishery resources and *inter alia* will be concerned with (1) the aquatic biosphere, and the physical and chemical phenomena concerned with the proper understanding thereof; (2) identification and description of the natural units of the stocks of aquatic organisms; (3) migratory, feeding and reproductive habits; (4) rates and causes of recruitment, growth and mortality; (5) the measurement and analysis of population levels and their fluctuations and the effect of fishing operations thereon and (6) increasing fish-cultural production through the development and application of biological techniques.

2. The Committee on Technology will deal with specific problems on the development and proper utilization of the fisheries with special reference to (1) the capture, preservation, processing, distribution, marketing, and consumption of fish and fishery products; (2) fish-pond engineering and management; (3) statistics; (4) equipment, facilities and techniques; and (5) economic factors such as financing and manpower.

These Committees will prepare detailed reports on the national programmes now being followed by various member countries in their respective areas, and suggest for the consideration of the Council at its next session, parts of such programmes as could best be carried out by various member nations with a view to conserving resources and achieving results at the earliest possible date.

During the plenary sessions of the Council, 15 technical papers dealing with such varied subjects as hydrology, biology, habits and food of fishes, fish culture, refrigeration, processing of fish, preparation of oils and bye-products, assessment of stocks and economics of the industry were read and discussed. A symposium on Pelagic Fisheries, to which a number of papers were contributed by the delegations from India, United States of America, Netherlands and Australia was held in three after-dinner meetings.

Special excursions were arranged for the delegates to study types of fishing methods and fish-culture practices in the Singapore area. A film on methods of Hydrological Research with a commentary by Dr. H. Thompson of Australia was shown, and specimens of the important food fishes of Malaya with photographs of the fish and the fishing methods were exhibited.

The Executive Committee during the first year will have as its members:—

Dr. Baini Prashad (India)—*Chairman.*
Dr. J. F. D. Hardenberg (Netherlands) —*Vice-Chairman.*
Dr. G. L. Kesteven (F.A.O. Regional Representative for Fisheries) —*Secretary.*

The following were elected Office-bearers of the two Technical Committees:—

1. *Hydrology and Biology*:—
   Dr. N. K. Panikkar (India) —*Chairman.*
   Mr. W. H. Schuster (Netherlands) —*Rapporteur.*
2. *Technology* :—
   Dr. C. Amirthalingam (Ceylon) —*Chairman.*
   Mr. Claro Martin (Philippines) —*Rapporteur.*

An invitation was received from the Government of Australia for the Council to hold its 1950 session in Australia, and it is very likely that this invitation will be accepted.

EASTERN STUDIES AT OXFORD

OXFORD University has approved a statute making permanent the Spalding Professorship of Eastern Religions and Ethics and expressed gratitude to the benefactors, Mr. and Mrs. K. N. Spalding, whose new gift of £ 42,000 had made this possible.

This particular Chair was first established for a provisional period in 1935 and has been held since then by Dr. S. Radhakrishnan, who is a Fellow of All Souls College, Oxford, and has been Vice-Chancellor of Andhra and Benares Universities and is recognised as one of the greatest Asian educationists.

He is at present Chairman of the Executive Board of UNESCO and of the Indian Universities Commission recently appointed by the Indian Government.

The new statute making the endowment of the Chair permanent reiterates the desire of the founders to promote closer understanding between the world's great religions and makes it clear that the intention is normally to appoint an Asian in the Chair.

THE DISTRIBUTION OF RAINGAUGES IN THE DAMODAR RIVER CATCHMENT

K. S. RAMAMURTI
(*Poona*)

A GOOD estimate of the probable discharge of a river is essential for designing any project to harness its water resources. Since the discharge is calculated from the total quantity of water that has fallen as rain in the catchment, it is essential that the number and location of the raingauge stations in the catchment should be so designed as to give the best estimate of the average rainfall in the area. The total quantity of water would then be the average rainfall of the stations in the area multiplied by the area of the catchment.

It was pointed out in a previous note[1] that a non-uniform distribution will give a higher weightage to the rainfall recorded in the regions with a denser distribution of raingauges and less weightage to that in the regions with sparser distribution. For example, the average normal rainfall during June to September over Hyderabad State calculated as the average of the rainfall recorded at different number of raingauge stations has been worked out and compared with the weighted mean calculated on the assumption that all the districts have approximately equal areas. Even if the areas are not equal, it is always possible to allot to each district mean an average area from or including the district. The normal rainfall data of Hyderabad stations have been taken from the *Memoirs of the Indian Meteorological Department*, Vol. 27, Part 5.

1. Average of 20 stations that have records from dates prior to 1920 .. 25·9″
2. Average of 65 stations that exist now .. 27·7″
3. Average of 45 newly added stations .. 29·7″
4. Average of 31 of these newly added stations which are situated in the Godaveri basin in the northern part of Hyderabad where the rainfall is comparatively more .. 33·6″
5. Average of 17 stations chosen one in each district .. 26·3″
6. Average of the district means .. 26·6″

The district means are calculated as the average of all the stations in the district. Assuming that the areas of all the districts are equal, the average of the district means will be the weighted average and hence may be taken to be a good estimate of the average normal rainfall over the State. It will be seen that the average normal rainfall calculated from the 17 evenly distributed stations, one in each district, gives almost as good an estimate. The difference is only 0·3 in., about 1% of the weighted average. The average of 65 stations is too high by 1·1 in.; that of 45 newly added stations by 3·1 in., and that of 31 new stations by as much as 7·0 in. Therefore it is evident that an increase in the number of raingauge stations does not necessarily give a more accurate estimate of the average rainfall.

In the following note it is proposed to consider the number and the distribution of raingauges necessary in the Damodar river catchment so that an unbiased estimate of the average rainfall may be arrived at with a reasonably small standard error. That the distribution of raingauges should be uniform is brought out in the following analysis also.

The Damodar river* rises in the hills of Chota Nagpur and flows in a generally southeasterly direction till it changes its course abruptly to a southerly direction below Raniganj. Its principal tributary stream is the Barakar river. The origin of the river is approximately at 2,000 feet above mean sea-level. At the point of junction of its two prongs on the western border of Hazaribagh district, the united stream starts at an elevation of 1,326 feet above mean sea-level; but in its course of 93 miles through Hazaribagh district, its fall averages 8 feet per mile and leaves the district with an elevation of only 582 feet.

The above description of the course of the river gives also an idea of the ruggedness of the basin.

Rainfall data are available for 22 stations in the Damodar river catchment down to Asansol from the year 1923 onwards. The figure below shows the catchment area, the location of the raingauges and the normal

* Vide *The Imperial Gazetteer of India*, 1908, **11**, 132-33.

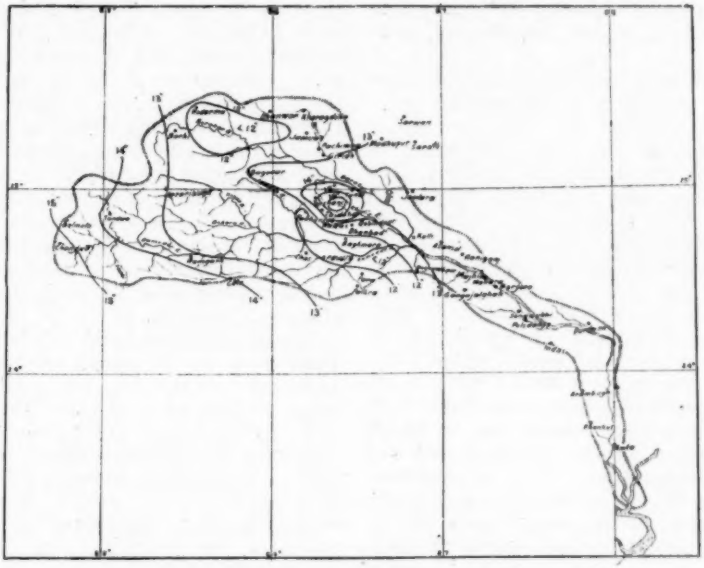

FIG. 1. Catchment of the Damodar river
Normal rainfall in July

isohyets for July. July rainfall of these stations for the years 1923 to 1940 have been used in the following analysis.

Analysis of variance of the rainfall during July for the years 1923 to 1940 in the Damodar river catchment

S. S. due to	D.F.	S.S.	Mean S.S.	F.
Year ..	17	4,219·70	248·2176	18·2214*
Space ..	21	962·32	45·8247	3·3639*
Residual ..	357	4,863·18	13·6223	
Total ..	395	10,045·20		

* Significant at 0·1% level

Note.—S.S.—sum of squares, D.F.—degrees of freedom, F.—variance ratio.

The variance due to years as well as that due to space are significant. That is, the variation of rainfall from year to year as well as the variation due to orography are significantly more than the residual variation. Now let us consider the best design for sampling rainfall in space. The intra-class correlation coefficient, ρ is equal to $\frac{M_{\bar{x}} - M}{M_{\bar{x}} + (n-1)\, M}$, where $M_{\bar{x}}$ is the unbiased estimate of variance or the random variation present in the material sampled, M is the variation within the sample or the systematic variance, and n the number in the sample. Since $M_{\bar{x}} < M$, ρ is negative and significant. Madow and Madow (1944) have shown that if the serial correlations have a negative sum, systematic sampling is better than random sampling. It is also shown that the sum of the serial correlations is $(n-1)\,\rho$. Since ρ is negative in the case of spatial distribution of rainfall in the Damodar river catchment, a better unbiased estimate of the average rainfall could be got by employing systematic sampling design than random sampling design. The variance of the mean is given by

$$\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}\{1+(n-1)\,\rho\},$$

where σ is the standard deviation of any observation.

Therefore systematic sampling design, which was already suggested on the basis of computational convenience,[1] and found to be good in estimating the average normal rainfall of Hyderabad State, is better than random sampling design in the case of collection of rainfall data, as rainfall is generally

subject to certain systematic influences like lateral instability of the atmosphere, orography, etc.

The 22 stations in the catchment have been ranked according to the normal rainfall and were grouped into two samples by taking all the stations with odd ranks to form one sample and the rest another. The sample variance was calculated from each year's data. The 18 separate estimates of the between —sample variance thus calculated were tested for homogeneity by Bartlett's (1937) test. $-2 \log \mu$ works out to be 15·4838 and C the corrective factor is 1·35. For 17 degrees of freedom $-2 \log \mu$ is not significant at 50% level and the corrected value of it is not significant even at 90% level. Therefore, despite the fact that these individual variances are based on a single degree of freedom, it may be concluded that these are homogeneous. That is, the residual variance is due to chance causes which are independent of time and space effects. The pooled sum of squares of the 18 separate estimates, each with a single degree of freedom, is 9·932. The error variance has been estimated to be 13·623 based on 357 degrees of freedom (refer table). The value of F for these two estimates is 1·372. Hence the two estimates are not significantly different and we may assume 13·6223 to be the error variance of any observation.

The error variance of the average rainfall in the catchment based on 22 raingauge stations is therefore 0·6192 and the standard error 0·79 inch, which is 6% of the average normal rainfall (13·31 inches) in the catchment. Therefore, if the 22 stations are distributed evenly in the catchment, the average of these stations will be an unbiased estimate of the average rainfall in the catchment with a standard error of 6%. And this much accuracy is fairly sufficient for all practical purposes. It may also be mentioned that the distribution of raingauges in the Damodar river catchment is fairly uniform but for a small cluster of stations around Topchanchi (see fig.).

Though only the total rainfall of July has been used in the above analysis, it is felt that the results will be applicable to the total rainfall of a smaller number of days as well and that the 22 stations may be sufficient to calculate the average rainfall due to a storm, etc. However a verification is necessary.

The author is thankful to Dr. S. K. Banerji and Dr. W. F. Kibble for kindly going through the manuscript.

1. Ramamurti, K. S., "On estimating the average depth of rainfall over an area and the distribution of raingauges," *Curr. Sci.*, 1948. **17**, 317-18. 2. Madow, William, G., and Lillian H. Madow," On the theory of systematic sampling, I," *Annals of Math. Stat.*, 1944, **15**, 1-24. 3. Bartlett, M. S., "Properties of sufficiency and statistical tests," *Proc. Roy. So .*, London, 1937, **160A**, 268-82.

INDIAN SCIENTISTS' TOUR OF AUSTRALIA

KEEN interest in the scope of scientific investigation in Australia and in the facilities availbale for modern research, was shown by the four members of the Indian Scientists delegation who have just returned after completing their tour of Australia.

The tour was arranged by the Australian Council for Scientific and Industrial Research, a government authority organised on somewhat the same plan as the Indian Council with a central authority, and sections in the provinces.

The leader of the delegation, Dr. S. Krishna, C.I.E, Ph.D., D.Sc., F.I.C., F.A.Sc., Director of Forest Products Research, Forest Research Institute at Dehra Dun, and a foundation member of the National Institute of Sciences, represented India at the Fifth Empire Forestry Conference in London in 1947.

Another member, Dr. D. P. Pal, M.Sc., Ph.D., F.L.S., F.N.I., joint Director of the Agricultural Research Institute, is specially interested in the breeding and genetics of wheat, potatoes and tobacco.

Representative of Indian medical research was Lieutenant-Colonel M. L. Ahuja, M.B., Ch.B., M.D., D.P.H., Director of the Central Research Institute, Kasauli, and a member of the governing body and the scientific advisory body of the Indian CSIR.

The fourth member, Mr. V. P. Sondhi, M.B.E., M.Sc., F.G.S., F.N.I., is Deputy-Director of Geological Survey, New Delhi.

Visit to Canberra

On arrival at Darwin, Northern Territory, the scientists flew over the northern State of Queensland from Darwin, in Central Australia, to Brisbane and on February 21 they arrievd in Sydney.

At Canberra, the national capital, the visitors inspected CSIR laboratories and were received by the Governor-General of Australia, the Rt.-Hon. W. J. McKell. They met also the Prime Minister, the Rt.-Hon. J. B. Chifley, and were impressed by the friendly personalities of both the Governor-General and the Prime Minister.

The scientists attended a reception given by the High Commissioner for India, Lieutenant-Colonel D. S. Bedi, to the Australian Minister for External Affairs, Dr. H. V. Evatt. Among places visited in the national capital were the Commonwealth Forestry and Timber Bureau, the Australian Institute of Anatomy and the Commonwealth Observatory at Mount Stromlo.

Irrigation Areas

Travelling by air, the delegation then visited the irrigation areas on the Murrumbidgee River at Leeton and Griffith, in the State of New South Wales. There they saw farms on which rice and wheat are grown.

The visitors were very interested in the emus and kangaroos of which they obtained their first view as the delegation travelled through the countryside.

At Boonoke station, in the Deniliquin district of Riverina, the visitors were able to inspect Australia's most famous Merino stud. About 70,000 sheep are run on the property. At the stud they were shown 25 rams each worth more than Rs. 10,660.

The delegation passed through Echuca a Murray River township in the State of Victoria which is a centre of dairying and wheat growing. At Shepperton, in the Goulburn Valley, they inspected the extensive fruit-growing areas which support the biggest fruit canneries in Australia.

At a Press conference in Melbourne, they pointed out that the great Australian wheat research authority, William Farrer, had used Indian varieties of wheat in the course of his breeding experiments, and that some of the Indian strains exist in Australian wheatfields to-day.

Forestry Research

Because of the nature of the work carried out at the Forest Research Institute at Dehra Dun, Dr. Krishna found his main interest in Melbourne in the activities of CSIR's Forest Products Division. Its modern laboratories conduct research into matters relating to timber and the utilisation of forest products generally. Dr. Krishna showed keen interest in the work of the various sections, which are devoted to wood structure, wood chemistry, timber physics, and mechanics, seasoning, preservation, veneer and gluing, and utilisation of timber products.

At the University of Melbourne Dr. Pal renewed acquaintances with former students who are studying in Australia, and inspected the laboratories of the Physics School.

Mr. Sondhi was received by the Director of Commonwealth Bureau of Mineral Resources, Dr. H. G. Ragett, and inspected the maps and technical records and mineral specimens at the Bureau.

Medical Institute

Lieutenant-Colonel Ahuja was particularly interested in the medical research work carried out by the Walter and Eliza Hall Institute, which is world famous for investigations into the problems of pathology and medicine. The Institute is directed by Professor F. M. Burnett, F.R.S., and Ph.D. (London). Important activities undertaken at the Institute include large-scale production of influenza virus vaccine, study of snake-bite and virus deseases of man and animal and the chemical detection of poisons.

On March 2 the scientists flew to Hobart, capital of Australia's island State of Tasmania where they visited the University of Tasmania, and inspected the State's hydro-electric power stations. They returned to Melbourne on March 6.

Brown Coal and Paper

By motor car from Melbourne the delegation was taken to Yallourn and Maryvale. At Yallourn the world's biggest known brown coal deposits are used by the Victorian State Electricity Commission in its extensive electric power plant which serves the City of Melbourne. At Maryvale, the scientists visited the Australian Paper Mills, one of the largest companies in the industry and were interested in the process by which brown paper is manufactured from fire-charred timber.

Lectures were given to the Australian Chemical Institute by Dr. Krishna and at the Melbourne University, by Dr. Pal.

Before returning to India, the scientists visited also Perth, Adelaide, Brisbane, Newcastle and Sydney.

SWEET POTATOES (*IPOMOEA BATATAS*)

B. SEN

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Introduction

IN India sweet potato is commonly looked upon as an inferior food crop. In spite of the fact that sweet potato can help in a great measure to relieve our acute shortage of both food and fodder, up to this time it has not attracted the attention it deserves.

Even in the U.S.A., the increased interest in sweet potato is of comparatively recent origin. It was the demand of the Army for dehydrated food during World War II, and stoppage of normal imports from abroad of root starch, which brought out the importance of sweet potato in the U.S.A. By 1945, the total value of the U.S.A. sweet potato crop was of the order of Rs. 44 crores.

Dr. Julian C. Miller of Baton Rouge, Louisiana, has estimated the comparative nutritive values of edible portions of ordinary white potato and sweet potato. His unpublished data is produced in Table I.

TABLE I

Composition of food (edible portion in one pound)

	Calories	Protein	Fat	Carbohydrates	Calcium	Phosphorus	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid
		gm.	gm.	gm.	gm.	mg.	mg.		mg.	mg.	mg.	mg.
Sweet potatoes ..	567	8	3	127	159	222	3·2	17,200	·45	·32	5·9	113
Irish potatoes ..	386	9	·5	87	36	222	3·4	180	·41	·23	5·4	45

It will be seen from the above table that sweet potato ranks higher than ordinary potato in most categories, particularly in carbohydrates, calcium and vitamin A. Moreover, the yield of sweet potato per acre has been found to be higher than that of ordinary potato. Tender end-lengths of sweet potato vines can also be used as a table spinach. A few plants would be sufficient to supply the spinach requirements of a family for a whole season. Small samples of sweet potatoes can easily be sun-dried by the cultivators and made into flour for their own use, as is now commonly done in villages in India where sweet potatoes are cultivated. For handling large quantities, modern dehydrating machines can be utilised with profit. Experimental trials in India have shown that 20% of sweet potato flour, or even more, can be mixed with *atta* for chapattis. The result is both nutritious and palatable.

Apart from the higher yield of the edible roots of sweet potato, as compared with ordinary potato, the vine terminals and leaves constitute an excellent source of fodder. Nearly 1¼ tons of high quality dried sweet potato leaf meal can be obtained per acre. The feed value is approximately equal to that of alfalfa hay, as will be seen from the unpublished data of Dr. Julian C. Miller in Table II.

TABLE II

	Protein	Fats	Carbohydrates	Mineral Matter
Sweet potato leaves and terminals	12·6%	3·5%	45·5%	10·2%
Alfalfa hay ..	14·7%	2·0%	36·4%	8·3%

Thus the roots and tender vine endlengths of sweet potato offer a very nutritious food for human beings, and the stringy roots and the bulk of the stems and leaves make an excellent fodder for cattle.

Sweet potato also has a number of important industrial uses: it can be utilised for the manufacture of starch, industrial alcohol, pectin, carotene and syrup.

Experiments

Through the courtesy of Dr. Julian C. Miller of Baton Rouge and Dr. C. E. Steinbaur of Beltsville, Maryland, I obtained two roots each of 14 strains of high yielding and disease-resistant sweet potato. Roots of two strains of Bengal sweet potato

and cuttings of two strains of Bombay sweet potato were also obtained for comparative trial. All these were planted in Almora on March 21st, 1948. On account of the limited number of cuttings of each strain available at any sowing date, a properly replicated experiment could not be undertaken in 1948. Sowings were continued from May 1st to June 26th, 1948. Each strain was planted in a separate plot—10′×10′. The distance between rows was 3′ and between plants 12″. For root multiplication, a very late sowing was undertaken on July 8th, 1948, at the U.P. Government Farm at Hawalbagh. The weights of the roots and of the tops (vines and leaves) of each row were recorded at harvest time. From the nature of these preliminary experiments no exact estimate of the comparative yield of the different strains is justified.

Nancy Hall
(High yield and high carotene content)

Ranger
(High yield and high carotene content)

Triumph
(High yield and high starch content)

Bengal White
(High yield with high moisture)

FIG. 1

Compared to the yield of the ordinary potato, the yield of sweet potato is much higher. For instance, in a sowing of February 1948, of several strains of U.S.A. ordinary potatoes, the highest yield calculated on an acreage basis was of the order of 220 mds. from the strain Essex. On the other hand, the highest yield of sweet potato was of the order of 435 mds. from the Bengal White variety, and 388 mds. from the U.S.A. Nancy Hall. (Photographs of roots of some the strains are given in Fig. 1). Obviously, the yield figures given in Table III are not likely to be obtained by the cultivators, until adequate facilities become available for improving their cultural practices. Under similar cultural conditions, however, not only will the yield of the more nutritious sweet potato be higher than that of ordinary potato, but the supply of much needed fodder will be an additional gain. The fresh weights of the tops of different strains of sweet potato as indicated in Table III show that it might even pay us to grow sweet potato on a large scale for fodder alone. From the records of the yield of roots from rows planted at different dates, it was found that the yields from the first rows of the different strains were invariably higher than those from the latest plantings of the cuttings in the third rows. The yield of Orange Little Stem and of B. 4306, planted on

June 25th, and of M. 4, planted on July 6th, was poor, and yields of all strains planted at Hawalbagh on July 8th were much lower compared to the yields obtained from the earlier sowings in Almora (Table III).

TABLE III

Showing yield, calculated on acreage basis, of roots and tops of different strains of sweet potato observed in Almora and Hawalbagh

Strain	Roots		Tops	
	at Almora	at Hawalbagh	at Almora	at Hawalbagh
	Mds.	Mds.	Mds.	Mds.
1 Unit I ..	148	121	494	346
2 Nancy Hall	388	119	180	318
3 Triumph ..	347	120	268	166
4 Ranger ..	302	112	501	166
5 B-196 ..	291	208	451	194
6 B-219 ..	322	82	400	304
7 B-4004 ..	294	214	440	97
8 B-4306 ..	79	52	509	581
9 B-5941 ..	313	..	175	..
10 Yellow Jersey	235	113	196	137
11 Jersey Big Stem	289	92	324	28
12 Pelican Processor	289	..	201	..
13 Orange Little Stem	99	..	..	..
14 Bengal White	436	201	345	189
15 M. 4 ..	126	..	319	..
16 Bengal Purple	301	..	411	..

To find out the strains best suited for any given region, properly planned co-ordinated sowings should be undertaken in different regions with all available strains of sweet potato, both Indian and foreign. This is essential because the yield and the quality of the roots will depend not only on the strain, but also on the climatic factors of different regions. From a series of plantings at different dates, the best sowing date for a particular region has also to be determined, because the yield and the quality of the roots vary according to the date of planting. For instance, in Almora, the Bengal White variety gave the highest yield; while in Hawalbagh, U.S.A. strains B. 4004 and B. 196 gave yields higher than that of Bengal White. On the other hand, we found that the moisture content of roots of Bengal White was 83%, whereas that of Nancy Hall was 69% and of Triumph 63%. Therefore, on the basis of solids, the yield per acre of Bengal White was 74·46 mds., compared to 120·28 mds. for Nancy Hall and 128 mds. for Triumph.

I take this opportunity to acknowledge the help of all members of the staff of this Laboratory, particularly of Shri Tara Datt Pant in the supervision of the field work, and of Shri Shankar Lal Sah in the despatch of 32,000 vine cuttings, sent on request to different provinces. The expenses of this preliminary work were met from financial aid received from Shri Charat Ram, New Delhi.

A detailed paper on this subject is in the press.

SCIENCE AND RELIGION

IN a lecture on "Science and Religion" given under the auspices of the Catholic Action Association, Delhi, Dr. Wolsky of the UNESCO expressed the view that due to the particular method of scientific research there were limitations on scientific knowledge. Whilst scientists study natural phenomena by measuring them they do not tell us anything about essence and existence, about the value and final explanation of life, matter, energy, of heaven and earth. These problems cannot be measured by measurements. All what Science can do is to give us a picture of the world and the universe. To form an opinion about the meaning and value of this picture, to arrive at a firm religion is left to him who sees the picture as a whole and not only its details. This he is able to do as a free human being and aided by God's grace. Now the scientist who has the desire to form views on the essence and value of things must be aware that whilst he is forming these views he is no longer acting as a scientist but simply as a man using his mental faculties according to the general rules of logic for approaching religious truth. He must deliberately abandon his particular methods of science which are utterly unsuitable in dealing with the fundamental problems of philosophy and religion. He is now no longer a scientist and his approach cannot be scientific. When he comes to deal with the most fundamental problems of humanity, he is in a particularly more difficult position than other men of learning, *e.g.*, those employed in the humanities or in arts or letters. This is perhaps the real source

of the mechanistic, materialistic tendencies of certain scientists expressed in the Latin proverb "tres physici, duo athei," *i.e.*, out of 3 scientists 2 are atheists. This attitude leads one to formulate a scientific philosophy, a religion without revelation. These bear an innate contradiction in themselves, for science and philosophy and religion rest on different mental attitudes.

Recently, according to press reports, a leader of the Radical Democratic Party had accused Modern science, especially in supposed findings of 20th century Physics of giving birth to what he called a religious revivalism and a kind of neo-mysticism. The lecturer wished to assure the leader and those who may share his opinion that scientists in our days and especially religious scientists including Catholics do not intend to spread any sort of scientific mysticism as in their own interest of their own religious beliefs they just want to keep their scientific activities free from any non-scientific elements.

Scientists like J. Jeans who expressed the view that there is a supreme intellect beyond the universe were doing so not as scientific but as thinking men, free to express their views. They of cource based their considerations on real scientific findings. These findings however give only the background picture. The comments were made by the spectators, Jeans, Eddington, etc. not with scientific methods but with philosophical or theological reflections. Scientists like Haldane, Hogben and Prenant expressed views contrary to the Christian religion. Whilst they may be free to hold them, these anti-religious views are just as nonscientific as the so-called religious revivalism and neo-mysticism of Jeans, etc.

There was a danger to-day, said Dr. Wolsky, of politically controlled science but in an atmosphere of free science one need have no fear. If properly pursued it can never interfere with religion. Similarly, Catholic religious truth has its proper domain. All we want is to expose it clearly and explain it to the modern mind and to the millions who never had the chance to hear about it. We need freedom and tolerance. If this is granted, science and religion will strive side by side as parallel paths of truth which like parallels according to the Euclidean postulate meet in the Infinite, in the eternal truth of God.

METABOLIC MECHANISMS OF UNSTRIATED MUSCLE

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THERE are several metabolic mechanisms in unstriated muscle as shown by the effect of asphyxia, glucose, iodoacetic acid, etc., on the mechanical response of unstriated muscle.

Anaerobic mechanisms. When unstriated muscle from frog's or dog's stomach is asphyxiated, there is a stage of hyperexcitability before the response declines. This effects the response to alternating and direct currents, acetylcholine, potassium and tone. Tone may thus increase immediately on asphyxiation; this has to be distinguished from the later increase of tone. [1, 2]

The asphyxial excitability is of two kinds. One kind is increased by iodoacetic acid and depressed by glucose (0·1-0·2 p.c.); removal of glucose enhances the effect of asphyxia. This resembles the asphyxial hyperexcitability in the central nervous system which is increased by hypoglycaemia. [3] The second kind of asphyxial hyperexcitability is increased by glucose and depressed by iodoacetic acid as happens in the carotid body. [3] These two mechanisms are therefore antagonistic.

The inhibitory action of glucose on one kind of asphyxial hyperexcitability is succeeded by an opposite action, both these actions being abolished by iodoacetic acid. This indicates that the glycolytic mechanism at first suppresses the nonglycolytic one and then takes over from the latter.

The anaerobic utilisation of glucose appears to happen in two ways. When glucose is added to an asphyxiated muscle, there may be an immediate increase in response followed by a decline to a steady state or the response increases gradually to that state. There are two possible explanations for this. The first explanation is that the hyperexcitability on addition of glucose may be due to a substance, which is metabolised with glucose, but is soon exhausted. The second explanation is that asphyxia renders the muscle more sensitive to the action of glucose, this being due to the opening of reserve channels for its utilisation. This second explanation is supported by two facts. First, the inhibitory effect of oxygen on asphyxial hyperexcitability in glucose is readily shown. Secondly, iodoacetic may

at first increase the response.[4] The opening of reserve channels of metabolism probably accounts for the asphyxial hyperexcitability.

Tone producing substances relieve asphyxial arrest[1,2]. This action is atagonised by glucose, indicating that the above substances release a nonglycolytic mechanism. Tone producing substances may also hasten asphyxial arrest; it is presumed therefore, the suppressed mechanism is a glycolytic one. In the brain potassium suppresses the formation of latic acid during asphyxia.[3]

There is a glycolytic mechanism in acid solutions as shown by relief of asphyxial arrest by glucose. There is also a nonglycolytic mechanism for acid solutions as shown by the functioning of the muscle in the presence of iodoacetic acid[1,2]. The mechanism for acid solutions is not the same as that for alkaline solutions, as shown by the fact that asphyxial arrest is relieved by change of reaction. This can be done alternately several times, suggesting that the alkaline mechanism rests in acid solutions and *vice versa*. Ordinarily in an asphyxiated muscle poisoned with iodoacetic acid no recovery takes place unless oxygen is admitted. Iodoacetic acid diminishes but does not abolish the response on change of reaction, suggesting that rest only partly accounts for the recovery on change of reaction. Change of reaction has thus also a stimulating effect due to its tone producing properties. Glucose has an inhibitory effect also in acid solutions, showing that the glycolytic mechanism for acid solutions is antagonistic to the nonglycolytic one.

Aerobic mechanisms. Cyanide does not entirely abolish activity, which is further decreased by stoppage of oxygen supply, indicating that there are two aerobic systems, one involving cytochrome and the other involving a cyanide resistant substance, possibly a resistant cytochrome. The aerobic mechanisms are also divided into glycolytic and nonglycolytic which are antagonistic as shown by the inhibitory effect of glucose. Both the aerobic systems are antagonistic to the anaerobic ones as shown by the inhibitory effect of oxygen[1,2]. Sodium lactate and salts of fatty acids, such as sodium acetate, propionate, butyrate improve the response suggesting their utilisation[2]. After asphyxiation the muscle becomes more sensitive to oxygen indicating opening of reserve oxidative channels.

Inhibition. The responses of unstriated muscle are divided into two classes, inhibition and contraction[4,5,6,7]. That inhibition is active is shown by increase in oxygen consumption,[9] and its abolition by asphyxia and restoration by glucose. The anaerobic mechanism for inhibition is antagonistic to that for contraction as shown by the fact that asphyxia while decreasing inhibition may increase contraction. The aerobic mechanisms for both may also be antagonistic as shown by the fact that after asphyxiation, oxygen may increase tone, but diminish inhibition. Both inhibition and contraction may be subserved by the same mechanism aerobically as well as anaerobically, as shown by the identical effect of glucose in asphyxia and oxygen subsequently. The aerobic mechanism for inhibition may be antagonistic to the anaerobic one, as shown by the inhibitory effect of oxygen.

That relaxation of muscle may also be passive is shown by decrease in oxygen consumption of the relaxed musle[9], and absence of *rigor mortis*.

Contraction. The contractions of unstriated muscle are divided into four groups as produced by nervous stimulation, electric current, drugs such as adrenaline and acetylcholine and ions such as potassium and barium. Their susceptibility to asphyxia suggests that they are subserved by different metablic mechanisms[1,3]. Thus the susceptibility to asphyxia varies in the following order:— Nervous stimulation > electric current > drugs > ions.

The aerobic mechanisms of twitch and tone may be different[1,2]; this is shown by the fact that after asphyxiation, introduction of oxygen may increase tone and decrease twitch or they may be subserved by a common mechanism. The anaerobic mechanism for tone and twitch may be different as suggested by the following experiments: (1) addition of glucose to an asphyxiated muscle may increase tone and decrease twitch, (2) asphyxia may increase twitch though tone may be unaffected or actually decrease.

Though there are several metabolic mechanisms in unstriated muscle, they appear to be related and the metabolic compartments are not watertight. Thus oxygen may not have an inhibitory effect after asphyxia suggesting that the anaerobic mechanism functions aerobically also. Similarly both tone and twitch may be simultaneously increased by oxygen or glucose. The antagonism between the various metabolic mechanisms prevents utilisation of energy simultaneously from

two sources. When one source is opened, the other is closed, thus exercising economy in the expenditure of energy.

1. Singh, I., and Singh, S. I., *Curr. Sci.*, 1947, **16**, 259. 2. —, *Proc. Ind. Acad. Sci.*, 1948, **27**, 127. 3. Best and Taylor, *The Physiological Basis of Medical Practice*, London, 1945. 4. Singh, I., *J. Physiol.*, 1938, **92**, 62. 5. —, *Ibid.*, 1939, **96**, 367. 6. —, *Ibid.*, 1940, **98**, 155. 7. —, *Ind. Journ. Med. Res.*, 1942, **30**, 629. 8. —, and Singh, S. I., *Proc. Ind. Acad. Sci.*, 1948, **28**, 51. 9. Rao, M. S., and Singh, I., *J. Physiol.*, 1940, **98**, 12.

IN MEMORIAM[1]

THOMAS NELSON ANNANDALE

ON the 10th April 1949, some past and present members of the Zoological Survey of India assembled at the Scottish Cemetery, Calcutta, to pay their respectful homage to the sad and loving memory of Dr. Thomas Nelson Annandale, the founder-Dricetor of the Survey, who died on the 10th April 1924, twenty-five years ago. Wreaths, flower bunches and loose flowers were laid on the grave and those present stood in silence for some time remembering his brilliant career in India, his erudite learning, his love for the staff and his manifold kindnesses and courtesies to many. It was decided by those, who knew Annandale personally, that every year on this day they should assemble and pay their homage to his memory with floral tributes.

The Royal Asiatic Society of Bengal, with which he was closely associated throughout his period of service in India as Anthropological Secretary, Vice-President, and as its President in 1923, perpetuates his memory by a triennial award of the Annadale Memorial Medal on a person who has made the most important contribution, during the previous five years, to Anthropology in Asia and the first award was made of Dr. Fritz Sarasin in 1928 in honour to Dr. Annandale's lifework in physical anthropology. Thereafter the award has been made alternately for physical and cultural anthropology. The Society has also a sepia portrait and an oil painting of Annandale in its rooms. In appealing for funds to perpetuate the memory of Annandale, the Council of the Society paid to him the following tribute:—

> "Dr. Annandale occupied the foremost place in the ranks of Indian Zoologists. His scholarly research work earned for him meritorious recognition from the premier scientific Society in the world. His enthusiasm for the cause of scientific education in India was abiding. In him was combined the rare distinction of a scholar, erudite and industrious, and a personality, modest but engaging."

It is also in the programme of the Society "that the balance of income of the Annandale Memorial Fund be suitably invested until the accumulated amount is sufficient, after paying for the triennial award, to provide Rs. 250 a year, to be utilised for a biennial Anthropological Lectureship.

Annandale was the last Superintendent of the Indian Museum and this office he held from 1907 to 1916. He succeeded Col. Alcock and relinquished the office on becoming the first Director of the Zoological Survey of India. The Trustees of the Indian Museum have also perpetuated his memory by putting up a brass tablet in the premises, the inscription on which reads as follows:—

> "In memory of Thomas Nelson Annandale, C.I.E., M.A., D.Sc., Driector, Zoological Survey of India, Superintendent and Secretary to the Trustees, Indian Museum. Born 1876, died 1924. Erected by the Trustees as a token of their esteem."

Lt.-Col. R. B. S. Sewell, C.I.E., F.R.S., Cidevant Director, Zoological Survey of India, at the request of the undersigned wrote a review of Annandale's work in India which is being published in the *Records of the Indian Museum*. It brings out very clearly how Annandale was far ahead of his times, for to him any taxonomic work involved correlation of the fauna " with the climate, the geographical position and geological formation, the vegetation and the composition of the water of each district surveyed." He was of the opinion that "No one formula can express, much less explain, evolution." He very often told the writer that it was his intention to write a book on "Evolution" during leave which he intended to take when death snatched him away from us. His later writings show the magnitude of the loss suffered by the scientific world through his early death, for he had intended to incorporate the whole of his investigations and wide experience in his contemplated publication on "Evolution."

S. L. HORA.

[1]An Obituary Notice of Nelson Annandale by the late Dr. S. W. Kemp appeared in the *Records of the Indian Museum*, 1925, **27**, 1-28.

OBITUARY

PROFESSOR BIRBAL SAHNI, M.A., D.Sc., Sc.D., F.R.S.
1891–1949

THE cutting short of Birbal Sahni's life at a time when a new epoch of further fruitful activity appeared to be commencing for him came as a painful shock to every one. I had myself sent him a telegram, ten days prior to his death, expressing my confident hope that the newly established Institute of Palæobotany would, under his direction, make valuable contributions to science and to national welfare. At this juncture, when India's science is being reorganized under a new dispensation, Sahni could indeed ill be spared. It is appropriate that *Current Science* should publish appreciations of Sahni's life and career from several India's leading botanists. These naturally contain expressions of their profound sorrow at his being called away in the midst of his work.

I had known Sahni myself for thirty years, having first met him when I was a guest at his father's house in Lahore, delivering a course of lectures at the Punjab University. Since then, we had come together, travelled together and worked together many times and at many places. Every fresh contact only served to strengthen the impression produced on me of a most lovable personality, full of vigour and enthusiasm, and endowed with an unbounded passion as well as a very remarkable capacity for scientific achievement. Amongst the many pleasant memories which I carry in my mind is of my stay on more than one occasion at Lucknow as the guest of the Sahnis in the beautiful home which they built for themselves on the banks of the Goomti river. I cannot help feeling that it was in the highest degree appropriate that it was ultimately decided to locate the Palæobotanical Institute in the city with which the Sahnis were for so many years and so happily associated.

It is scarcely necessary for me to write anything more, except to add that I associate myself fully with all that has been said by his distinguished scientific colleagues in the following pages.

C. V. RAMAN.

IT is my task, honourable yet painful, to pen a few lines about the late Professor Birbal Sahni, Sc.D., F.R.S., both as a man and as seen against the background of science. But in these few lines I do not propose to present anything like a critical estimate of Prof. Sahni's career, for the simple reason that I stood too near him to be able to possess that aloofness without which no such estimate can be usefully attempted. This very nearness, which disqualifies me to a certain extent, gave me exceptional opportunities to become acquainted with his innermost thoughts and hopes, with his ideals and aspirations, and with the main springs of that magnetic influence, which he exercised on all who came in contact with him.

Born on November 14, 1891 in the Punjab, he was the second son of the late Prof. Ruchi Ram Sahni of the Government College, Lahore. After a distinguished career at the Central Model School and at Government College, Lahore, he left for England in 1911 and joined Emmanuel College, Cambridge. After taking his degree in Natural Sciences tripos with high honours he took up research under the renowned palæobotanist Sir Albert Charles Seward. His inspiring guidance created that love for research in young Sahni which can be found only amongst great masters of a subject. While at Cambridge Sahni received grants from the Royal Society and from his own College in aid of his valuabe researches. He remained in England throughout the first World War and in 1919, after his D.Sc. of the London University he returned to India to join the Benares Hindu University as Professor of Botany. In 1920 he left the Hindu University to take up his appointment as Professor of Botany at the Government College, Lahore. But within a year he left Lahore to take up his appointment as Professor of Botany at the newly started University of Lucknow, where he remained till his death. His sudden and untimely death only six days after the laying of the foundation-stone of the Institute of Palæobotany has deprived us of one of the world's greatest botanists.

The first thing that struck any one who came to know Prof. Sahni, was his pure, fervent and profound love for Science. In all my experience, I have met only one other, so utterly absorbed, day and night in thoughts of science and that is Sir C. V. Raman. To these two, India's past was and is a matter of great and legitimate pride,

PROFESSOR BIRBAL SAHNI, M.A., D.SC., SC.D., F.R.S.

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but even more than the past they thought of the present and future and this was the root of their matchless and astonishing activities in their respective and varied fields of scientific activities.

We all know how faithfully Prof. Sahni lived upto the ideal he set before himself. His was a noble mission, but the cost he had to pay for it was by no means a light one. I do not speak of the sacrifice of physical comfort which it involved, but the mental suffering which he had so often to endure. The present transitional state of our education in general and Science in particular, brought in its wake the conflict between two forms of duties, *viz.*, (*a*) the duties of the educationist and to secientist to the State and (*b*) the duties of a true devotee of Science wedded to research. He chose the latter path to which temperamentally he was also suited. For he lived and moved on a plane of his own far removed "from the madding crowd's ignoble strife".

Prof. Sahni's contributions to Botany, Palæobotany and Geology are mainly of the nature of his own original researches. Many of his extensive memories have been published in the *Philosophical Transactions of the Royal Society* and in various other foreign and Indian Journals. Beginning with some papers on living plants he published extensive papers on the structure and affinities of certain Zygopterid ferns. His detailed work on the revision of the Indian Gondwana plants started with a joint paper published in 1920 in collaboration with his teacher Professor Sir A. C. Seward. In these he not only described a number of entirely new fossil plants but by the employment of improved technique of investigation at his laboratory he was able to revise completely the knowledge about several old species and their geological ranges. Along with these and closely following them came his numerous papers on the structure and affinities of the various Indian fossil plants from the Palæozoic to the Quarternary beds. In his latest epoch-making paper published just before his death, he founded a new group of Gymnosperms—the Pentoxyleæ.

Besides the morphological and structural aspects of fossil plants he has dealt with the succession and geographical distribution of fossil floras against their climatic, physical and evolutionary background. In addition Sahni's researches have materially helped to elucidate and solve such vexed geological and palæobotanical problems as Wegener's theory of continental drift, the age of the Deccan Intertrappean beds now settled as Eocene, the age of the Punjab Saline series now largely recognised as Tertiary, the origin and character of the *Glossopteris* flora during the Palæozoic ice age and the "Himalayan uplift since the advent of man".

Prof. Sahni had a wonderful faculty of infusing the spirit of research amongst his varied students. And to his students, scattered all over the country, he was like the central sun from whom they derived their light and warmth and round whom they moved each in his own orbit and at his own distance. The feeling of devotion that he was able to inspire was reminiscent of the relationship of *Guru* and *Shishya* found in the ancient culture of India. While we may proudly claim him as our countryman, the discoveries of Science have belonged and must necessarily belong, to the whole world; and Sahni's achievements in Science are a part of the common heritage of all peoples.

In token of his great contribution to science various scientific societies in India and elsewhere showered on him their highest honours. He was made a Fellow of the Royal Society in 1936, was the General President of the Indian Science Congress in 1940 and quite recently he was elected to preside over the forthcoming International Botanical Congress to be held at Stockholm.

His brilliant success in the scientific field was in no small measure due to his charming and devoted wife Shrimati Savitri Sahni. She had been his life-long guide, philosopher and friend. On many occasions she has helped him in the corrections of his numerous papers and later shared a fair proportion of his administrative work connected with the Institute of Palæobotany. We share with her great loss and pray that God give her the necessary strength to carry through the unfinished task of Prof. Sahni.

I shall now close with a quotation by a great poet:

> "Farewell, farewell, a nation's love
> A nation's prayers watch o'er thee,
> Nor space nor time can part thee ever
> From hearts that here adore thee".

SHRI RANJAN.

ON the 10th April 1949, the botanical world suffered an irreparable loss by the sudden and tragic death of Professor Birbal Sahni, the Director of the Institute of Palæobotany, Lucknow, and, until recently, the Professor of Botany and the Dean of the University of Lucknow. India has lost one of its greatest sons. It was just a week previously that we were so happy over the fact that the foundation-stone of the Palæobotany Institute at Lucknow was laid under such delightful auspices by the Prime Minister, Pandit Jwaharlal Nehru. And a few days after this great event, we were still further overjoyed to learn the very happy news of Professor Sahni's election to the Presidentship of the Seventh International Botanical Congress at Stockholm in 1950, the greatest honour that could be conferred on a botanist. The establishment of an institute for palæobotanical research in India had been one of Professor Sahni's most cherished desires. He endowed practically all his property for the starting of this great institution. His idea in establishing this institution was that, apart from its work of carrying on research in palæobotany, it should have a wide international outlook and that it should strive to promote cultural contacts with other countries through an exchange of students and by inviting foreign scholars as Visiting Professors. It was most befitting that a great international personality like Pandit Jwaharlal Nehru should have honoured this international institute of Professor Sahni by laying its foundation-stone. It is a tragic irony of fate that, so soon after these two happy events, Professor Sahni should be snatched away so suddenly like this. He was cut off in the fulness of his powers. His contributions to palæobotany are rich and full. But he had still such a lot to do for his science and for his Palæobotany Institute.

He was born on the 14th November 1891 at Bhera, Shapur District, West Punjab, and was the second son of Professor Ruchi Ram Sahni, M.A., Emeritus Professor of Chemistry, Government College, Lahore, and Shrimati Ishwar Devi Anand. He married in 1920 Savitri Suri, younger daughter of the late Shri Sundar Das Suri, M.A., Inspector of Schools, Punjab.

He was educated at the Central Model School, Lahore, Government College, Lahore, and at Emmanuel College, Cambridge (where he was a Foundaton Scholar and Exhibitioner and secured the Hardyman Research Prize). He also attended the Summer Semester at the Munich University.

He was one of the founders of the Indian Botanical Society which was started in 1921 and was its President in 1923. He was Vice-President of the Indian Association for the Cultivation of Science for some time, President of the National Academy of Sciences of India for two years in 1937-38, Government Delegate to the Imperial Botanical Conference in London in 1935, Delegate to the Tercentenary of Musèum d' Historie Naturelle, Paris, 1935, Fellow and Vice-President of the Indian Academy of Sciences, Fellow and Vice-President for some time of the National Institute of Sciences of India, President, Lahore Philosophical Society, Fellow of the Royal Asiatic Society of Bengal, Non-Official Member, Indian Delegation to Royal Society Scientific Conference in 1946.

He was elected a Fellow of the Royal Society in 1936, being the fifth Indian to be elected for this honour. He was a Fellow of the Geological Society and a Foreign Honorary Member of the American Academy of Arts and Sciences.

He was the President of the Botany Section of the Indian Science Congress in 1921, President of the Geology Section of the Indian Science Congress in 1926, and President of the Botany Section of the Indian Science Congress Jubilee Session in 1938. And he was General President of the Indian Science Congress Meeting at Madras in 1940.

He was a Vice-President of the Palæobotanical Section of the Fifth International Botanical Congress at Cambridge in 1930, and a Vice-President of the Palæobotanical Section of the Sixth International Botanical Congress at Amsterdam in 1935. And, just before his death, he was elected the Honorary General President of the Seventh International Botanical Congress at Stockholm in 1950.

He was awarded the Barclay Medal of the Royal Asiatic Society of Bengal in 1936 for outstanding researches in Biological Sciences, the Sir Cattamanchi Ramalinga Reddy National Prize for National Technology in Sciences, Agriculture and Technology in 1947, and the Nelson-Wright Medal of the Numismatic Society in 1944.

He was Professor of Botany, the Benares Hindu University, during 1919-20, and was,

later on, Honorary Professor of Botany at the same University. He was Professor of Botany, University of Punjab, during 1920-21, and Professor of Botany, University of Lucknow during 1921-46, and Dean of the Faculty of Science of the Lucknow University during 1933-46. He became the Founder-Director of the Institute of Palæobotany in 1946.

He had a most charming manner, and a frank and engaging countenance. And, with his ready smile and his large and bright and thoughtful eyes, he had almost a boyish appearance. In fact, in heart and mind, he actually did remain young and energetic throughout his life. He was always simple, sincere, modest and unassuming and was most gentle and kind to every body. He was greatly loved and respected by the younger generation of research workers, on account of his geniality and his readiness to give them all possible help whenever necessary. And he commanded the affection and high regard not only of a large number of scientists but also of persons in other walks of life. In foreign countries, he was held in very high esteem, and numerous eminent foreign scientists were attached to him as personal friends.

By nature, he was ardent, enthusiastic and energetic in anything that he undertook. His industry was amazing. And his own industry and zeal was always infectious and could be seen reflected in every one of his research students and colleagues. It was this unique quality of his which enabled him to gather round himself a large body of enthusiastic research workers and which helped him to establish finally a great school of research in Palæobotany at Lucknow.

He did much to further botanical research in India, not only in his own special branch, *viz.*, palæobotany, but in all the other branches of the subject as well. He had a burning desire to raise the standard of botanical research to the high level that is seen in foreign countries, if possible, even to a higher level. Surely he had succeeded to a very large extent in this attempt. He was a great nationalist in his outlook, but I must however, point out that his nationalism was not so bigoted as to prevent him from being a great internationalist as well.

He was an excellent speaker and had a very agreeable voice. His lectures and public addresses were always a delight to hear. Both in his speeches and in his publications, he always expressed himself most clearly and faultlessly. Crystal clarity of thought and careful planning characterised all his publications.

After having had an excellent training in research work in palæobotany under the late Professor Sir Albert Steward at Cambridge, he returned to India in 1919. When he came to India, he found that the study of Indian fossil plants was occupying only a very subordinate position in Indian Botany. Though a good deal of knowledge of fossil plants had accumulated, all this knowledge was due to the work of the geologists, who were interested in the study of plant fossil merely as indices of the geological strata. None of the Indian botanists had taken up the study of the fossil plants of the country, and not much was known regarding the structure and affinities of most of these fossil plants. So he immediately started an intense and sustained research work on the Indian fossil plants. He also trained up a large number of students and members of his teaching staff in research work in palæobotany.

During the years 1919 to 1949, he and his colleagues published a host of most valuable papers on palæobotany. Among the many outstanding palæobotanical problems that were tackled by him may be mentioned: The Gondwana flora; the Deccan Intertrappean flora; the age of the Deccan Traps; the age of the Saline Series; Micropalæontological work for correlating the oil-bearing rocks of Assam for the Burma Oil Company; Wegener Theory of Continental Drift; the age of the Glossopteris flora; and the land connection between Gondwana Land and Angara Land. Among the other publications may be mentioned several papers on the Jurassic flora of the Rajmahal Series, the fossil flora of the Karewa beds in Kashmir and the light they throw on the Himalayan uplift and the climatic changes in the Kashmir area, Pentoxyleæ, a new group of Jurassic Gymnosperms showing a combination of features characteristic of the Cycadales, Coniferales, and Bennettitales, *Homoxylon* and its systematic position, etc., etc.

He summarised the position of palæobotanical knowledge in India periodically in his masterly addresses before the meetings of the Indian Science Congress, the Indian Academy of Sciences, and the National Academy of Sciences. He also organised several symposia under

the auspices of these learned bodies on various important palæobotanical problems many of which had important bearings on geological problems, especially the ages of certain series. Professor Sahni was very largely responsible for bringing the botanists and geologists together. In 1926, in his Presidential Address before the Geology Section of the Indian Science Congress Meeting at Bombay, he said that fossil plants represented a debt that botany owes to geology. In the conclusion of his presidential address before the Botany Section of the Indian Science Congress Jubilee Session in 1938 at Calcutta, he said that the botanist had by his study of the fossil plants been able to repay at least a part of the debt he owed to the geologist. He had helped the geologists through a study of the fossil flora to decide the age of several strata.

Professor Sahni has also published some valuable contributions to Archæology and Numismatics.

During his last days, he was busy working on the Devonian flora of Spiti and the silicified flora of the Rajmahal Hills.

It is not easy to assess the full extent of the loss that the botanical world has sustained through the sudden passing away of this great man. The void left by him cannot be filled for a long time to come. Only posterity will be able to form a real estimate of his great contributions to Botany. He has left behind him a great tradition, a great example and a wealth of knowledge, which will be a constant source of inspiration to all botanists and will keep his memory green and alive wherever palæobotany is studied.

M. O. P. IYENGAR.

HAVING had the privilege of being associated with the late Professor B. Sahni for nearly twenty-two years, first as a student, then as a collaborator and colleague, I value very highly indeed the kind invitation extended to me by "*Current Science*" to offer my humble homage to the memory of my illustrious *guru*.

I shall endeavour to give in this brief note my impressions of India's greatest botanist as a teacher and as a leader of botanical research, two aspects with which I have been familiar more than anybody else.

Professor Sahni was not only a gifted teacher but also an ornament to the profession. His profound knowledge of the subject and his natural style were unrivalled. He was inimitable. It was a treat to listen to his lectures. They were characterised by remarkable clarity, directness of expression, a simple and lucid style and a wide sweep of facts. He was very exact in his expression and meticulous in his language. Professor Sahni had the knack of making the most difficult problems exceedingly clear, particularly to the graduate classes, first stressing the most important facts in the order of their importance and then drawing in details. The students loved this direct and simple style, which they could follow without any effort, and gathered full strength to attend his lectures.

His lectures to the post-graduate classes were bound to be heavy with a wealth of facts and details. There was no time limit to it; there was no waste of time or words either, but facts poured in quick succession and perfect sequence all in a convincing fashion. Difficult problems were made exceedingly clear and new theories were explained in a masterly way. All sides of a controversy were placed equally clearly without prejudice to any and there was no compulsion to favour any view, except to be guided by facts and facts only. One was always struck by his remarkable mastery of the subject and its wonderful exposition. With the above gifts Professor Sahni combined a wonderful skill in sketching. With miraculous speed he would sketch on the blackboard the necessary figures without leaving a single detail and facts and figures would always keep pace with each other in his lectures.

It was a regular habit with him to enter in his notes all references to the latest work as soon as it appeared in print. So his lectures were always up to date and even unpublished work or work in progress in the department would be referred to. Complete references to original papers were invariably given whether they were in his notes or not for he had a wonderful memory and his references to published literature were accurate almost to the page. Even during these lectures the idea of research would always be in the background. After finishing each group in his lectures, he would invariably draw attention to various research problems in that group—particularly in India. For the post-graduate student whose aim was research or even for the student who had just embarked on a re-

search career, his M.Sc. lectures were not only enormously informative but also exceedingly suggestive. Many of the outside workers, even teachers from outside who used to join the department for the Ph.D. or D.Sc. classes, would invariably attend his M.Sc. lectures and profited by it immensely. Professor Sahni could handle any subject with ease and mastery. He was as much at home in lecturing on Fungi or Genetics or Systematic Botany as he was in lecturing on the Morphology of Angiosperms of Pteridophytes or Gymnosperms. In fact he has taught all these subjects some time or other to the degree and post-graduate classes although latterly under pressure of work he had confined himself to the last two groups of botany in which he was naturally in his best elements. Particularly his treatment of the group Gymnosperms of which he was a master was simply marvellous. Whether it was his class-room lectures or lectures to a lay audience, he held the audience spell bound by his eloquence, correct pronunciation, right accents and a free and natural diction.

In the practical classes too Professor Sahni never rested for a minute. He was always explaining something or correcting some books or discussing some problem and would invariably come round to research and give a few useful tips. This would go on sometimes even beyond the scheduled hours often late into the evening but none grumbled for one used to learn such lot during these informal talks. Himself a very hardworking person he expected others also to work hard and nothing pleased him so much as a hardworking and conscientious student. One of his favourite sayings was *"Hard work killed no body"*. He insisted upon neat, orderly and methodical work, accurate sketching and correct labelling and attention to details. The clumsy and careless worker would always invite a severe but nonetheless courteous rebuke often sarcastic, which was very effective indeed. In the class-room Professor Sahni was a perfect disciplinarian but induced it by his own exemplary behaviour, and unfailing courtesy than by any harsh words. Even the most turbulent class would become absolutely quiet immediately he entered the room.

Another sign of greatness in him which I have seen in the class-rooms was his admitting frankly his ignorance of certain things. To some kinds of unanswerable questions he would offer no teleological explanations but would mystify his young audience by the simple statement 'I do not know'. He would follow this by suggesting books where the point might be looked into further and would ask the students to come to him if they had any difficulties.

As a director of research Professor Sahni was unrivalled. He inspired the love of research in every one who came in contact with him. He could make a good research scholar of any kind of student. He had the gift to draw out the best in every student by sympathetic interest and timely encouragement. He would offer a wide choice of problems to the new research scholar and after the selection was made would sit with him regularly and give detailed instructions and references. Research was the passion of his life and he expected every scholar to share it. He admired conscientious and hard work even if it did not yield quick or spectacular results. He insisted always upon a very high standard of research—stressing more on quality than on quantity. He was critical, sometimes hypercritical in examining the student's work; his results were subject to the most rigorous scrutiny, all in the interest of the student himself. Once the results and the research paper were approved by Professor Sahni the student was supremely satisfied. He knew that his work was fully purified. Professor Sahni insisted on the research paper being fully illustrated and flawless in every detail. The language had to be very exact and opinions guarded. Superficiality, hasty conclusions and irrelevant facts always irritated him. He hated the ponderous style and involved constructions. He always used to say "Know what you have to say and say it straight". He insisted on brevity, directness and clarity. 'Never use two words when one can serve the same purpose' was his maxim. When facts were not sufficiently convincingly put he would say curtly with a smile 'I am not convinced'. 'Put yourself in the place of the reader who does not know the subject and see if you are convinced' he would add, correcting the manuscript. He had an eagle eye for details in research as well as in publication. Not a single spelling mistake, typographical error or printer's devil would escape his eye. Professor Sahni's guidance in research was not only inspiring but also bred confidence and caution in the young worker—two qualities most essential for a successful research career. It was a pleasure to collaborate

with Professor Sahni in any research. The junior worker was treated as an equal, his opinion invited and more credit given to him than was his due.

Himself a great collector of plants—living and fossil—he insisted on his research scholars collecting their own material with complete field notes. His own tour notes and collection data are a mine of information, however hastily they may have been drawn.

Often have I seen him in the museum or class-room examining hurriedly specimens still to be worked out and wistfully exclaim "A life-time is too short for working out even a few of these silicified blocks". And yet how much he accomplished in his own brief life-time!

I cannot conclude this note without referring to the human side of this great scientist and teacher. His unfailing courtesy, personal charm, cheerfulness, refined manners and radiant smile, all contributed to his magnificent personality. He had a very fine sense of humour and would enjoy a joke even at his own expense. He mixed freely with students and it was mostly at informal gatherings or excursions that one could see the remarkably human side of him which was covered by a busy and restless exterior. He was a thorough sportsman and was a keen tennis player and chess enthusiast. A nationalist to the core he had always an international outlook in scientific and humanitarian fields.

Indian science has sustained an immense loss in the passing away of Professor Sahni. To the Department of Botany in this University which he organised and raised to the foremost centre of botanical research, it has been an irreparable loss. To me who had been associated intimately with him for more than two decades and had been influenced by his personality to a measure which cannot be expressed in words, Professor Sahni's demise has been a personal shock indeed. This has been so to numerous students of his who looked upon him as their greatest friend and beloved guide. Although his beaming face smiles at us no more in flesh and the inspiring voice is hushed for ever, yet to those of us who had come under its magic spell they will live for ever and ever in our memories. May his soul rest in peace!

A. R. Rao.

STUDENTS and colleagues of Professor B. Sahni, Sc.D., D.Sc., F.R.S., all over India were deeply grieved at the sudden and abrupt end of a great and distinguished career. To every student of his the loss is irreparable for, there has been such a great personal spell cast on us by this remarkable personality that we keep on repeating in our minds "Our beloved Professor is not gone, he is always with us". Such was the regard we had for Professor Sahni!

In 1934, I nervously entered the Botany Laboratory at Lucknow and met my Professor for the first time. I had sent in my card and was called in immediately. Professor Sahni got up from his chair and with his inimitable smile gave me a warm firm handshake. I was charmed by the personality, charmed beyond words. Those soft yet crisply spoken words of welcome still ring in my ears not dimmed in audibility by the passing of years and that momentous meeting started an affectionate relationship between teacher and taught and has continued ever since only to be prematurely broken by the passing away of my illustrious teacher.

Professor Sahni was a lucid speaker. His lectures were a delight; erudite, masterly and thorough, in short, *par excellence*. Who can forget his thoughtful introduction to the Pteridophyta, his genial and often humorous comments on the various views expressed by contemporary thought on the engrossing topics relating to evolutionary tendencies in the group? Who dare forget his masterly sketches, so swiftly and dexterously made with both hands! His excellent discourses on the Bennettitales, the Caytoniales, the fossil and living gymnosperms, the theories connected with the stelar evolution; the remarkable facility with which he would refer to the most intricate problems connected with the phyllode theory or any other, all remain a great treasure to those who have had the good fortune to have learned Botany from Professor Sahni.

Professor Sahni's greatest gift, perhaps, was his ability to put a student at ease. Ignorance of the individual in the matter of correct knowledge in the subject was to him no matter for ridicule. On the contrary, he would enlighten the young seeker with all the seriousness of a genuine teacher. I am reminded of an incident when I was doing my Master's Degree. On apologetically requesting the Professor to explain a particular struture in the sporocarp of Marsilia quick came

the answer, "a postmaster needs no request to affix the date stamp, so too the duty of a Professor, it is his privilege to teach!" Years later when I had the privilege of being on Professor Sahni's staff, short though the period was, I was called upon to deliver a talk on some of my researches. The post-lecture discussion was initiated by Professor Sahni in these words, "I shall be glad if all of you will heckle the lecturer; there is a misnomer amongst us that new ideas of a research worker should not be shared for common good. I may say this, the more ideas you give or take out of a research worker the more he will get. The most successful research worker never hesitates to discuss his new ideas with his colleagues". Such was his liberality on academic problems.

There were a number of outstanding characteristics of the Professor which are worthy of emulation. Foremost among these was his great humility. In the class-room he would seldom speak at length of the scientific contributions of himself, his students or colleagues. Another quality was his desire to give equal impetus for other workers to develop their fields of study. He would often state that the finances of his department had to be uniformly spent on all branches of Botanical teaching and research. It could be said without any fear of contradiction that the establishment of research schools in Plant Pathology, Physiology, Bryology and Ecology in his department, hand in hand with his special branch of Palæobotany, shows the tolerance and sagacity of the Professor. In many of his lectures he would refer to the importance of the various branches and stress the need for an all-round knowledge in all branches of botanical teaching and research.

There are many incidents that made a great impression on the Professor's students. In one of the lectures Professor Sahni was late by five minutes. As soon as he entered the lecture theatre, smart came an apology "in my long career as a teacher I have not been late by five minutes, I owe you my apology". That was characteristic of him! In the practical classes the Professor would give detailed instructions to every student and in spite of his multifarious duties, he would make it a point to attend to his work with the graduate students, the post-graduates and the research students, indeed, every little detail would be gone into. When closeted with research students he would stress the need for precision, neatness and promptness. Mentioning about promptness, I should like to record here that personal correspondence with the Professor was always a great pleasure for anyone, as they could depend on him for a prompt, courteous reply. I remember his mentioning to me that normally no letter was kept pending for more than twenty-four hours! Professor Sahni's interest in students went beyond his Department of Botany. As Dean of the Faculty of Science he had fixed hours of interview, when the under-graduates and post-graduates had an equally uniform reception. Indeed, many belonging to the other science departments were known to him by name—a tribute to his power of remembering faces and names.

There have been occasions when I travelled in this country with Professor Sahni. They were rare privileges when one would be faced with his profound humour, deep understanding of human problems and great simplicity. But more than these grand human qualities, he had a love and affection for his students which was unfathomable. In one of my train travels with Professor Sahni I was overwhelmed to see the Professor making towards my compartment at midnight to bid good-bye in the typically Sahnian fashion since he had to change on to another route. One could narrate so many incidents that have made a deep and everlasting impression on our minds. To us Professor Sahni's passing away is an irreparable loss, but to India, his geniality, sense and love of duty, devotion to the welfare of his pupils stand as soft focussed spotlights which I hope and trust may fall kindly on many a young rising teacher who might mould his character on that of the Doyen of Indian Science, our revered and respected Professor Birbal Sahni.

T. S. SADASIVAN.

LETTERS TO THE EDITOR

PROHIBITION AND HEALTH

The September (1948) issue of *Current Science* contains a masterly leading article on the "Scientific and Economic Aspects of Prohibition". But, I am afraid, some important health problems arising from Prohibition have been overlooked in the article. True, 'drink devil' has become a problem and a menace in regard to the health of the community. But, strangely enough, prohibition too will bring in its train a number of important health and nutritional problems, which the scientist and the administrator will do well to study.

In his book, "The Inequality of Man" Prof. J. B. S. Haldane, F. R. S., draws attention to the 'Tragedy of Nauru,' an account of which appeared in the *Proceedings of the Royal Society of Medicine* (1930).

"Nauru or Pleasant Island lies in the Pacific Ocean near the equator and contains large deposits of phosphate. So its inhabitants contribute to the world overproduction of food (Haldane refers only to the food situation in 1930) by exporting portions of their native land. They were in the habit of drinking toddy made from fermented palm-juice and on occasions became very tipsy in consequence, which doubtless lessened their efficiency as excavators. Nauru is governed by Australia under a mandate from the League, and the paternal Government issued an ordinance forbidding the use of toddy. Perhaps the efficiency of the natives as labourers increased, but their infantile mortality rose to 50% within six months of this law coming into force.

"It was found that the children at the breast were dying of beri-beri, a disease due to the deficiency of Vitamin B_1. This substance is nearly absent from the rather monotonous diet of the mothers, but is present in large quantities in the yeast from which the toddy is made. The Medical Officer of Health discovered this fact and (doubtless after an appropriate delay) toddy was allowed again. The infant mortality immediately fell to 7%.

"The situation in many areas of Central India is quite similar. Large sections of the population are on the borderline of Vitamin B_1 deficiency, and suffer from time to time from mild beri-beri. In these circumstances, adults generally survive in rather poor health, but breast-fed children die. This dietary deficiency is at least to some extent supplemented by the use of toddy made from palm-juice" (Haldane).

For the past several years, we have been experiencing the rigours of an unprecedented food-shortage. That means, we have been systematically semi-starved all these years. Our general health condition has, as a result, deteriorated, with the consequential diminution in our resistance to disease, The low rate of ration obtainable often happens to be very poor in quality. If our food was deficient in Vitamin B_1 even in the days when good-quality food was not scarce, surely there is reason to think that our present-day diet would be completely devoid of any trace of vitamins and other ingredients of special food-value. At best, we would be consuming only foods of 'fuel-value' such as those rich in carbohydrates—vitamins, proteins and minerals never coming into the picture!

Prohibition should be viewed against this background. Prohibition of distilled drinks, such as arrack and imported varieties, is quite welcome. Those drinks have no food-value and they do irreparable harm. But, prohibition of crude toddy takes away from the hands of the ordinary labourer, his only source of vitamin supply. The well-to-do members of the community invariably go in for 'costly drinks', which means distilled ones. Even if some of them have been using crude toddy, before the introduction of prohibition, they can now afford to turn to costlier ways of fighting Vitamin deficiency. To the common labourer, no such alternative exists.

It is therefore the duty of the Government to look into this matter at once. Along with the provision of recreational facilities to the drink-deprived, an organised effort should be made to distribute vitamin tablets free of cost, among the poorer sections of the population; a propaganda party should tour villages and towns to instruct the people as to the necessity of taking in the required quantity of vitamins. This should be followed up by extensive research to devise ways and means to "vitaminise" the common man's food. We hate taking pills daily for a life-time. Our ordinary diet should therefore be made to contain vitamins in sufficient quantity. Not only that, some cheap method, having a good popular appeal, should be developed to supplement our food with vitamins. For example, raw polished rice could be banned and unpolished parboiled rice compulsorily introduced instead. In the process of polishing, the outer layers of rice are removed. It is at present used as animal food, while it can be profitably used for human consumption in the form of bread and cakes. In Japan, it is used in pickling. The same method can be advantageously adopted in India, as pickles occupy a pride of place in Indian food. More use of vegetables, fruits, pulses, etc., may also be popularised. These are some only suggestions as to the courses research should take.

Another question, though not scientific, inevitably props up, when discussing prohibition. Is it worth-while to embark on prohibition at this juncture, at the cost of great nation-building schemes? To take but one example from Madras: Madras loses about 17 crores of rupees annually consequent on the introduction of prohibition. The Government have before them a good number of schemes to increase by millions our acreage of food-crops, by the construction of dams, etc. Some of these plans are either delayed or postponed indefinitely for want of funds. If therefore prohibition could be postponed by a couple or more years, we would be able to divert at least this seventeen crores to finance those schemes. When once our food position is secure, we can safely and with confidence, embark on our long-cherished ideal of total prohibition. Another thing: by postponing the introduction of prohibition by only one year, Madras will be able to give immediate effect to the abolition of the Zamindari system, as the compensation payable can be met from current earnings alone! These may seem a bit too harshly realistic; but we cannot escape these realities by simply shutting our eyes.

Trichur,
Cochin State, M. C. NAMBUDIRIPAD.
January 21, 1949.

ON THE SPECTRUM OF FLAME CONTAINING POTASSIUM SALTS

PANAY[1] has reported a continuous spectrum of potassium obtained by introducing into a Mecker burner air carrying atomised KCl solution. He has examined the intensity distribution in this spectrum between λ 5600 and λ 4110 and found a maximum at λ 4430 and a minimum at λ 5400. The continuous spectrum extends farther into the ultraviolet with gradually diminishing intensity and in the visible region, superposed over the continuum are a few lines of potassium, *viz.*, λ 7699-65, λ 4047-44 lines of the principal series, λ 6939-11, λ 5340-23 lines of the sharp series and λ 5360 line of the diffuse series, the D lines of sodium and two feeble lines at λ 4947 and 4637. A band at λ 5650 and another between λ 6180 and λ 6460 spreading possibly to λ 6050 and λ 6730 have also been noted by him.

To understand clearly how the continuum and the different bands and lines noted by Panay arise, the spectrum of flame containing atomised KCl has been photographed in essentially the same manner as by Panay and a continuous spectrum extending from the long wavelength limit of an Ilford panchromatic plate down to about λ 3000Å (fainter continuum extends to even shorter wavelength) has been obtained. The continuous spectrum in the visible region shows a maximum and a minimum near the regions described by Panay and has superposed over it the D lines, the C_2 bands at λ 5636, λ 5165, λ 4737, λ 4382, and the strong members of the OH bands at λ 3064. The red K lines could be seen visually but were beyond the sensitive region of the plate. The second members of the principal series of potassium appeared but no sharp series or diffuse series lines mentioned by Panay ware obtained.

To eliminate the effect of the gas flame, its spectrum uncontaminated by any salt, was photographed. This showed essentially the same features as above (including even the D lines). The inner cone of the flame gave the bands much stronger over the continuum than the outer cone. Further, the continuum was stronger in the flame containing KCl than in the one without it. The spectrum was also photographed with atomised NaCl in the flame. This again showed the same features as the KCl flame; the D lines were stronger.

It thus seems that the continuum referred to by Panay has nothing to do with potassium in particular. It rather belongs to the type of continuum which is ordinarily present in the flame and which has been attributed mainly to continuous electron radiation, i.e., radiation of the electrons in the field of ions formed in the discharge, by Finkelnburg.[2,3] The introduction of easily ionizable atoms like those of Li, Na, or K makes the continuum considerably stronger. Part of the spectrum might also be due to bimolecular association of the type of $NO+O=NO_2$+yellow green continuum of the flame (see Gaydon[4]). Further, it is also difficult to see how some of the lines can be attributed to the sharp and diffuse series of potassium, as has been done by Panay, when intervening members of the series like the λ 5802 line of sharp series and λ 5832 of the diffuse series are absent. By assuming that the wave-lengths given by Panay are only approximate it is possible to explain some of the radiations as due to C_2 or CH, but it does not appear feasible to explain all of them in any satisfactory manner. In the present case, however, although a continuum similar to Panay's has been observed, no extra radiation which cannot be explained has been found to appear on the plate.

Science College, S. P. SINHA.
Patna,
March 2, 1949.

1. Panay, T. N., *Compt. Rend. Acad. Sci. Paris*, 1937, **204**, 251. 2. Finkelnburg, W., *Phys. Rev.*, 1934, **45**, 341. 3. —, *Ibid.*, 1934, **46**, 330. 4. Gaydon, A. G., *Proc. Roy. Soc.*, *A*, 1944, **111**, 183.

NEW BANDS OF COLUMBIUM OXIDE

AN extensive band spectrum consisting of red-degraded bands and attributable to the CbO molecule has been observed in the region 6500-4200 A°.U., in the ordinary Columbium arc in air and in heavy current discharge through $CbCl_5$ vapour. They could be distinguished as two systems: (1) from λ 6500-5600 and (2) from λ 5600-4200. The first system presents a complex vibrational structure. The second is more open and well defined with band-heads accompanied by partially resolved rotational structure. The prominent heads occur in widely separated regions at ν 19120, 20340, 21320, 22163, 22878, the separations between successive heads being 1220, 980, 843 & 715

cm.$^{-1}$ The intensity distribution in these heads suggests the probability of v 20340 as the (0, 0) head. The two systems may be designated as γ and α respectively, on the analogy of the ZrO[1] and the TiO[2] bands which the present bands resemble closely.

Analysis of the bands is in progress and details will be published shortly.

V. RAMAKRISHNA RAO.

Physics Department,
Andhra University,
Waltair,
March 22, 1949.

1. F. Lowater, *Proc. Phy. Soc.*, 1932, **44**, 51. 2. *Ibid.*, 1928, **41**, 557.

GYPSIFICATION OF APATITES IN THE KODURITES

DURING the course of detailed chemical and optical studies of the Kodurites from the manganese mines of the Garividi area in the Vizagapatam district, a rather unusual case of the alteration of apatite to gypsum along the peripheral zones was noticed. The apatite is a manganese fluor variety with the formula $3(Ca.Mn)_3.P_2O_8.Ca\ (F_2.Cl_2)$. During the optical examination, it was noted that the periphery of the apatite showed different optical features from those normal to the apatite. The central grain shows uniaxial negative characters with straight extinction, whereas the peripheral zone is biaxial negative with inclined extinction which polarizes with second order blues and pinks, characteristic of gypsum. The analysis of the apatite and its modal composition indicated 92·93% of apatite and 7·07% of gypsum.

Chertification and kaolinisation are universal in the Kodurites. The problem of the origin of the cherts and kaolin in this area as elsewhere is a debatable point, i.e., whether it is due to hydrothermal or meteoric alteration.

Vogt[1] in common with several other investigators attributed kaolinisation of the felspars to carbonated waters. Lindgren[2] controverted this view on the ground that the pure aluminic silicate cannot be formed in the presence of carbonated waters alone and that the presence of H_2SO_4 is essential to bring about kaolinisation. Fermor[3] ruled out this possibility on the ground that there was no evidence of the presence of the influence and action of H_2SO_4 in the Kodurites. The gypsification of the apatites in the Kodurites of the Garividi area is fairly frequent and this points clearly to the action of sulphuretted waters. Therefore, it appears that the view put forward by Lindgren regarding the importance of H_2SO_4 in kaolinisation of felspars really finds a support here since there is a replacement of apatite by gypsum ($CaSO_4 \cdot 2H_2O$). The authors do not, however, claim that this alteration is brought about exclusively by hydrothermal agencies.

We are not aware of any reported occurrence of the gypsification of apatites in literature.

A detailed paper embodying the results of chemical and optical study of the Kodurites and associated formations by one of us (G. P. R.) is under publication elsewhere.

Geology Dept., C. MAHADEVAN.
Andhra University, G. PRABHAKARA RAO.
March 16, 1949.

1. Vogt, *Trans. Amer. Inst. Ming. Eng.*, **31**, 150. 2. Lindgren, Waldemer, *Ibid.*, **30**, 658. 3. Fermor, L. L., "Manganese-Ore Deposits of India," *Mem. G. S. I.*, **37**, 274-75.

VANADAMETRY—PART III

Volumetric Estimation of Ferrous Salt in the Presence of Phenols

IN Parts I and II of this series the advantages of sodium vanadate as a volumetric reagent in place of permanganate or dichromate have been emphasized. Viswanadham and Gopala Rao[3] have shown that citric acid in ferrisubchloridum citratum B.P. interferes in the estimation of ferrous iron, by potassium dichromate. They have proposed the use of sodium vanadate. Lyons and Appleyard[4] who found a similar intereference by citric acid and sugars proposed ceric sulphate for the estimation. Ferrey[5] showed that ceric sulphate does not give satisfactory results in the estimation of ferrous iron in the presence of phenol. As several phenolic compounds are used in pharmaceutical preparations as preservatives, it was considered necessary to investigate the problem in detail.

We have now found that dichromate oxidizes phenol, ortho-cresol, paracresol, *m*-cresol, and resorcinol, in the presence of ferrous salts by an induced mechanism. Ceric sulphate is capable of oxidizing the phenolic compounds even in the absence of ferrous salts to dirty coloured compounds

insoluble in dilute sulphuric acid, so that this reagent is not suitable for the estimation of ferrous salts in the presence of phenolic compounds. Sodium vanadate has, however, been found to give excellent results as shown in the following table.

Composition of solution		Amount of ferrous iron found by ceric sulphate titration	Amount of ferrous iron found by sodium vanadate titration
Amount of ferrous iron taken	Amount of phenolic compound		
millimols.		millimols.	millimols.
0·7191	nil	0·7200	0·7201
0·7191	0·5008 phenol	0·8230	0·7201
0·7191	0·5090 paracresol	0·8245	0·7201
0·7101	0·4684 ortho cresol	0·8212	0·7086
0·7101	0·4666 meta cresol	0·8194	0·7086
0·7139	0·4562 resorcinol	0·8945	0·7139

Sodium vanadate will thus be found to have some advantages even over ceric sulphate. Detailed results will be published elsewhere.

M. Narasimhasastri.
J. V. S. Ramanjaneyulu.
G. Gopala Rao.
Andhra University,
Waltair,
April 20, 1949.

1. Gopala Rao and Ramanjaneyulu, *Curr. Sci.*, 1949, **18**, 72. 2. Gopala Rao and Brahmaji Rao, *Ibid.*, 1949, **18**, 3. Viswanadham and Gopala Rao, *Ibid.*, 1943, **12**, 327. 4. Lyons and Appleyard, *Quart. J. Pharm. Pharmacol.*, 1937, **10**, 348. 5. Ferrey, *Ibid.*, 1937, **10**, 351.

THORIUM PERIODATE AND ITS USE IN THORIUM ESTIMATIONS

Ray Chaudhury[1] reports that thorium nitrate in dilute nitric acid solution yields on prolonged heating over a water-bath with excess of sodium paraperiodate a gelatinous precipitate of the composition $ThHIO_6$, $5H_2O$. This substance is further reported to be stable upto 600° C. The strength of the acid solution has not been specifically mentioned, but our experiments with 2N acid using potassium periodate in place of the sodium salt have not been successful. We have therefore undertaken a more systematic investigation and our experiments show that precipitation occurs only at IN or lower acid concentration. Even under these conditions significant quantities of thorium remain in solution though a ten-fold excess of periodate is used. If, however, hot neutral potassium periodate is added in slight excess to a hot neutral solution of thorium nitrate, there results immediately a white gelatinous precipitate, which may conveniently be filtered and washed through a sintered glass crucible. This, on drying at 105 to 110°C. for 3 to 4 hours, changes to a semi-transparent mass of constant weight, and composition as reported by Ray Chaudhury.[1] The time of drying is not critical, but the temperature should not rise much above 120° (even at 180° iodine vapours are observed). When the above procedure is followed, the precipitation of thorium is quantitative as can be gathered from the following typical results.

Wt. in g. of $ThHIO_6$, $5H_2O$ obtd.	Wt. in g. of thorium calculated	Wt. in g. of thorium taken
0·2471	0·1051	0·1055
0·2479	0·1054	0·1055
0·2368	0·1007	0·1008
0·2357	0·1002	0·1008

Thorium periodate precipitate is soluble in dilute mineral acids and can accurately be estimated volumetrically in the following way:—the washed precipitate is dissolved in dilute hydrochloric acid and a slight excess of potassium iodide is added. The iodine liberated is titrated against standard thiosulphate. One atom of thorium corresponds to one periodate group or eight equivalents of thiosulphate. The following example will illustrate the accuracy of the volumetric estimation 0·1055g. of thorium was taken. The estimted values were 0.1047, 0·1048, 0·1050 and 0·1052.

An interesting property of the periodate precipitate is that while it ordinarily retains five molecules of water of hydration, on prolonged desication (3 weeks) in vacuum over caustic potash, a part of this water is lost and its final composition corresponds to $ThHIO_6$, $4H_2O$.

Work on the use of periodates in the separation of thorium from cerium earths is in progress.

M. Venkataramaniah.
Bh. S. V. Raghava Rao.
Andhra University,
Waltair,
February 22, 1949.

1. Ray Chaudhury, *J.I.C.S.*, 1941, **18**, 335.

A NEW SYNCHYTRIUM ON *PHASEOLUS MUNGO*

A VERY severe disease on *udid (Phaseolus mungo* L.) causing defoliation was noticed on the Government Farm, Jalgaon, East Khandesh in August, 1948. A reference through literature showed that no species of *Synchytrium* was reported so far on this plant and that those reported on other legumes differed a great deal and hence it is proposed to assign it a specific rank.

Synchytrium phaseoli Patel, Kulkarni and Dhande sp. nov.

Leaves are covered on both sides with quadrilateral to polygonal crusts, measuring 1–2 × 1 mm. when quadrilateral. Several crusts when limited by veins coalesce. Colour of crust on the upper surface is deep-brown while it is pale brown on the lower surface. Infection occurs rarely on petioles.

Resting sporangia many in a crust, but one in each host cell, spherical to slightly ellipsoidal, smooth, with thick dark brown wall, measuring 18·0-26·6 μ (average 22·8 μ) in diameter. Endospore spherical, olive brown, smooth, thick walled, 3·5 μ thick epispore.

On leaves and petioles of *Phaseolus mungo* L. (Urd bean), Jalgaon, India, August 1948.

The authors are thankful to Rev. Fr. H. Santapau, S.J., of St. Xavier's College, Bombay, for the following Latin rendering of the description.

Synchytrium phaseoli Patel, Kulkarni and Dhande pec. nov.

Foliorum utraque facies cooperta costris quadrilateralibus vel polygonalibus, quadrilateralibus quidem 1—2 × 1 mm. magnit. Plures costræ, cum venis limitantur, coalescunt. Costrarum color in facie superiore est fusce brunneus, in inferiore vero facie pallide brunneus. Infectio raro in petiolis invenitur.

Sporangia quiescentia plura in singulis costris, sed singula occurrunt in singulis plantæ hospitis cellulis. sphærica ad tenuiter ellipsoidea, levia, crassis et fusce brunneis parietibus ornata, magnit. 18.0—26.6μ (mediet. 22·8 μ) in diam. Endosporium sphæricum, olivaceo-brunneum, leve, crassis parietibus præditum ; episporium 3·5 μ crassum.

In foliis et petiolis *Phaseoli mungo* L. (Urd bean), in loco Jalgaon, India, mense augusto 1948.

Plant Path. Laboratory, Agricultural College, Poona,
M. K. PATEL.
Y. S. KULKARNI.
G. W. DHANDE.

January 15, 1949.

A CASE OF SIMULTANEOUS MUTATION OF TWO INDEPENDENT GENES IN THE CHILLI *CAPSICUM ANNUUM* L.

THERE are several cases of spontaneous mutation involving a single gene, but cases of simultaneous mutation of wo tor more genes occurring spontaneously are perhaps rare. A case of simultaneous mutation of two independent genes, one determining the colour of ripe fruit and the other plant habit, has been recorded in the chilli crop in this Division. The colour of ripe fruit, red or yellow, is only a varietal difference, the bulk of the commercially grown chillies being red fruited. In the chilli collection in this Division both red and yellow fruited varieties are present. As regards compact plant habit with fruits appearing in clusters no variety in the collection of this Division possessed these characteristics, nor is the author aware of the existence of such a variety. A plant with such characteristics, which arose as a mutant, was first observed in this Division and described as " Bunch " mutant (Deshpande, 1940).

Genetical investigations in this crop have shown that red colour of fruit is a single dominant to yellow and normal plant habit dominant to compact habit (Deshpande, 1933, 1941).

In the year 1943-44 in the progeny of a single, unselfed plant of N. P. 34, which has red fruits and normal plant habit (Shaw and Khan, 1928), plants with compact habit and plants with yellow fruits also were observed. On taking counts the frequencies were found to be as follows:—

	Normal habit		Compact habit		Total
	Red fruited plants	Yellow fruited plants	Red fruited plants	Yellow fruited plants	
Frequencies observed	12	3	4	1	20
Frequencies calculated on 9 : 3 : 3 : 1 ratio	11·25	3·75	3·75	1·25	20

It may be seen from the data that the agreement between the observed and the theoretical frequencies on the basis of two factor difference is very close.

That this segregation is not the result of a natural cross with the "bunch" mutant recorded earlier (Deshpande, 1940) or with a yellow fruited type is evident from the fact that the fruit size and shape in all the plants of the segregating progeny were uniform, whereas the "bunch" mutant referred to above has much longer fruits, besides being red fruited and the fact that no yellow fruited type in the collection has the size and shape of the fruits of the mutant.

This therefore is a clear case of two independent dominant genes mutating simultaneously to their recessive condition. The parent plant of the segregating progeny of N. P. 34, which had normal plant habit and red fruits, must have been heterozygous for the two genes controlling the two characters involved. This heterozygous condition may have resulted from the mutation of the dominant alleles for normal habit and red colour of ripe fruit.

From this segregating progeny pure breeding plants with compact habit and red and yellow fruits respectively have been isolated and added to the collection of chilli varieties maintained at this Division.

Indian Agricultural Research Institute, New Delhi,
March 7, 1949.

R. B. DESHPANDE.

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INDEX FOR EARLINESS IN SUGARCANE

RIPENING in sugarcane is a vegetative process unlike in the case of grain crops in which latter sexual processes are involved. In the former, ripening is largely season bound but the degree of ripening depends upon the age of the shoot, soil and climatic conditions. Active growth of sugarcane more or less coincides with the monsoon periods, and ripening starts with the slackening of growth and the onset of cold dry months. There are varieties which ripen early or late. Thus, ripening may be said to be a resultant of the external as well as internal factors.

Among the external factors which bring about ripening may be mentioned (*i*) Soil type, (*ii*) Soil moisture, (*iii*) Fertility status of soil, (*iv*) Manures applied and (*v*) Cultural practices. There is abundant literature discussing the effects of these factors on ripening, and hence for the sake of brevity they are not mentioned here.

Regarding the internal factors very little work has been done. Study of varietal differences in regard to earliness and degree of ripening have been a regular feature of the work of Sugarcane Research Stations everywhere. Clement and Kubota (1943) from Hawaii studied the problems of primary index and fixed upon the total sugar level of the elongating cane sheaths expressed as per cent. of dry matter. But Borden (1945) reported wide range of variability of this primary index from his studies on replicated plots. Hartt (1939) and Clements and Kubota (1942) have reported on the moisture contents of sugarcane. These authors discussed the moisture content in different parts of the plant and the elongating leaf-sheath was chosen as reliable tissue to be used as moisture index.

Growth of cane by dry weight method was recorded by me in respect of two replicated field experiments at Anakapalle during the season 1948-49. Fortnightly increases in dry matter and moisture % in leaf, sheath, growing spindle and stem were recorded from July to February. The variants in the two aforesaid experiments are: *Ratoon experiment*:— Variety Co. 419. (*a*) ratoon crop, (*b*) plant crop. *Monthly planting experiment*:—(*a*) Co. 419 planted in the months of (*i*) March, (*ii*) April, (*iii*) May, (*iv*) June. (*b*) Co. 475 planted in the same months as Co. 419. The data collected are too elaborate to be reported here but data for two typical periods are furnished below (see Table),

A perusal of the entire mass of data shows that the moisture content is closely associated with the ripeness of cane. Corresponding analysis of juice was not done for obvious reasons that such a correlation was not anticipated before. But this correlation is inferred from the fact that ratoon crop and Co. 475 on one hand and the earlier plantings in the case of varieties on the other, are earlier in maturity than the plant crop and late plantings respec-

Date of sampling	Variety	Month of planting	Moisture content as % on wet basis			
			Entire plant	Green leaf	Sheath	Stem
14-9-48	Co. 419 :					
	Ratoon	March	79·41	69·64	81·85	84·22
	Plant	,,	81·94	71·27	85·86	85·37
31-12-48	Co. 419 :					
	Ratoon	,,	70·24	63·26	78·88	74·52
	Plant	,,	74·61	65·67	81·17	77·45
30-8-48	Co. 419	March	79·83	66·41	85·76	84·52
		April	83·07	68·24	84·63	87·75
		May	84·87	71·98	86·46	89·27
		June	81·30	73·76	85·70	88·67
	Co. 475	March	77·29	64·61	78·28	79·77
		April	78·24	67·00	78·85	82·38
		May	82·97	70·03	83·33	87·58
		June	82·02	71·40	84·02	90·59
10-2-49	Co. 419	March	70·19	63·52	76·67	73·87
		April	71·64	61·33	76·69	73·68
		May	73·21	63·27	72·65	74·41
		June	74·45	64·31	75·50	77·14
	Co. 475	March	67·35	58·48	73·01	67·50
		April	68·92	60·38	73·36	70·27
		May	68·08	64·12	74·98	72·86
		June	68·70	62·84	74·12	69·89

tively. Moisture content in plant parts falls progressively as the cane matures. The moisture % is subject to fluctuation to some extent on the soil moisture and climate, but more mature canes and the early maturing varieties proportionately record less moisture than the corresponding controls. This establishes a close relationship between earliness of cane and the moisture content of the tissues.

To further test this point, which occurred to me late in the season, moisture content in 4 important varieties in short crop stage was studied and the data are reproduced below: —

Variety	Moisture %			Remarks
	Leaf	Sheath	Stem	
Co. 527	68·22	79·57	82·36	Early variety
Co. 449	70·48	76·75	79·47	Mid season
Co. 475	70·58	82·09	83·87	Mid season
Co. 419	71·64	82·71	85·56	Late variety

Further tests in progress in my laboratory confirm the above relationship.

The following conclusions are possible:—

1. Even when the soil is in its maximum moisture-holding capacity, varieties exhibit characteristic differences in the moisture in the different plant parts.
2. The maximum moisture holding capacity of the tissues is closely associated with the earliness and richness of cane.

It is therefore hypothesised that earliness is inversely related to the moisture-holding capacity of the tissues.

Many of the agronomical findings recorded so far in various Research Stations can be explained in terms of this new hypothesis: to mention a few examples (1) withdrawal of water from soil hastens maturity, (2) dry climate hastens maturity, (3) high dosage of N delays maturity, (4) porous soil hastens maturity, (5) shallow root system hastens maturity.

Under all these conditions, the plant is likely to be forced to retain less moisture in its tissues.

This finding opens up the possibility of testing the earliness or richness of cane, now that the prime factor for richness of juice and earliness are known in seedling stage itself. There is great scope to devise agronomical practices which will hasten maturity.

Further details of this hypothesis on the maturity of sugarcane and its importance in both cane breeding and cane agronomy are under detailed study on this station.

The data reported here form part of Sugarcane Research Scheme subsidised by the Indian Central Sugarcane Committee to which body my grateful thanks are due.

S. V. PARTHASARATHY.
Sugarcane Res. Station,
Anakapalle,
March 12, 1949.

Borden, R. J., *Haw. Pl. Rec.*, 1945, **49**, 259, Clement Harry, F., and Kubota, T., *Ibid.*, 1943, **47**, 257. Clement Harry, F., and Kubota. T., 1942, *Ibid.*, **46**, 17. Hart, Constance, E., 1939, *Ibid.*, **43**, 145.

NOTE ON THE OCCURRENCE OF THE WEEVIL *DIOCALANDRA STIGMATICOLLIS* GYLL., AS A PEST OF THE COCONUT PALM IN TRAVANCORE

SPECIES of the Curculionid, *Diocalandra*, have been recorded as pests of the coconut palm from several parts of the Oriental and Australian regions. According to Hermes,[1] *Diocalandra taitensis* Guerin., bores into fronds, trunks, spikes, spikelets, and young

nuts, and causes total loss of nuts, when larvæ attack spikelets. Tailor[2] observes that this pest breeds in any part of the plant that has been injured by other causes and has begun to decay. Jepson[3] recorded *D. frumenti* F. for the first time from Ceylon in 1923, but Fletcher[4] who observed it earlier in India, in 1918 reported large trees having been killed by this pest. There has been no further mention about any of these weevils, from India.

In the summer of 1947, the writer came across a dozen trees infested by larvæ and adults of *Diocalandra stigmaticollis* Gyll.,* in a coconut plantation near Quilon, at the mouth of a small rivulet which empties itself into the Nadayara backwater. The soil of the place is of the alluvial type, rich in humus, and the entire area is subjected to flooding in the monsoon, and to water-logging during the rest of the year. The plantation contained about 700 trees, all under twelve years of growth. In the affected trees, one or more of the entire leaves, or parts of it, presented a blackened, scorched, and shrivelled appearance. In the initial stages of attack, the fronds were green and healthy, but grubs were seen in numbers, infesting the mid-ribs of these green fronds. In more advanced stages, small cavities were present in the mid-rib; these cavities being filled with a resinous secretion of the colour and consistency of thick molasses. The cavities were just large enough to hold a full-grown larva, but neither dead nor live stages of any insect were present in them. In the last

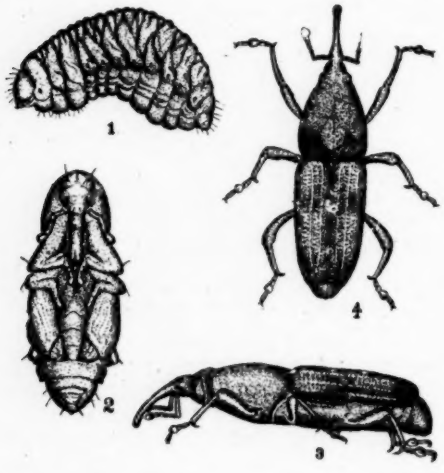

PLATE 1. Showing stages of *Diocalandra stigmaticollis* Gyll.

1. larva. 2. pupa. 3 & 4. adult. × 10.

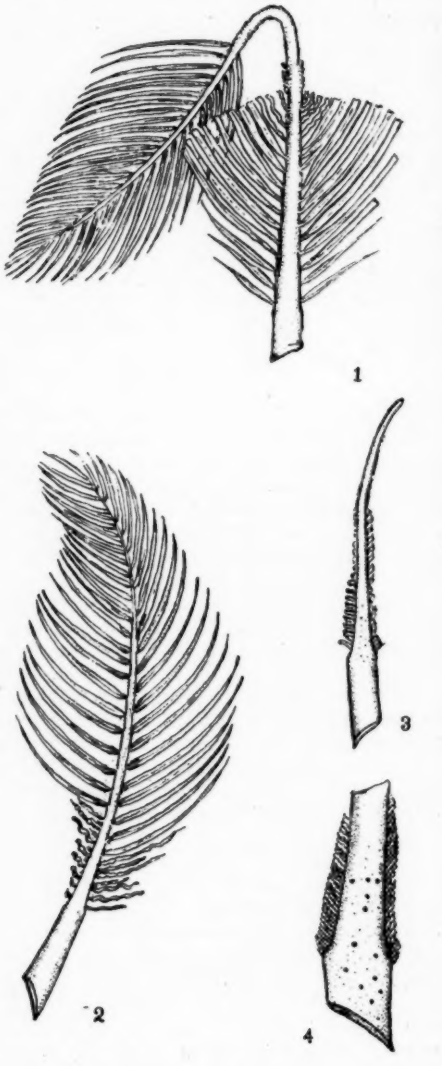

PLATE II. Coconut fronds showing damage by *Diocalandra stigmaticollis* Gyll,

1 & 2. Showing partial damage.

3. Complete damage.

4. Near view of basal portion showing exit holes of weevils.

stages of attack, the entire leaf had dried up, and the basal portion of the mid-rib showed numerous exit holes of adult weevils. Two trees which had the worst attack, had the young fronds and spikes very badly affected and the nuts in the older spikes were small and malformed. These trees were rendered so useless that they had to be cut down.

The insect responsible for this damage, is a small weevil, dark tan in colour, with a faint dark patch on the prothoracic region. It is about 6 mm. long, and 1·5 mm. broad across the thoracic region, and the snout is long and pointed, with a gentle inward curve. Larvæ are of a dull white colour, with the posterior half of the abdomen well developed. Repeated observations of the infested locality showed that in about three to four months, the attack lessened in vigour, and after about three to four weeks of monsoon rains, it practically disappeared.

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Central Research Institute,
University of Travancore,
Trivandrum,
March 16, 1949.

* Specimens were indentified by the kind courtesy of the Forest Entomologist, Indian Forest College, Dehra Dun.

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TELIA OF THE LEAF-RUST ON TEAK

Uredo Tectonæ Racib., inciting the leaf rust of teak was first described by Raciborski[6] in 1900 from Java. The rust is widely distributed in the areas where teak is grown. Raciborski described the uredial stage of this rust, and for the last 49 years no other spore form is known in spite of the abundance of the rust in all teak plantations. The uredia are numerous and almost plaster the lower surfaces of the leaves and hasten defoliation. The damage is especially severe in nurseries where the young plants are retarded in growth due to premature defoliation.

The writer has been studying the rust for several years during which period, only uredial stage (Fig. 1) was noticed. The rust can be collected in the uredial stage all round the year, though during some months very few leaves remain on the tree due to premature defoliation. The urediospores readily infect young leaves and produce secondary uredia. A continuous watch was kept to find out the possible occurrence of telia,

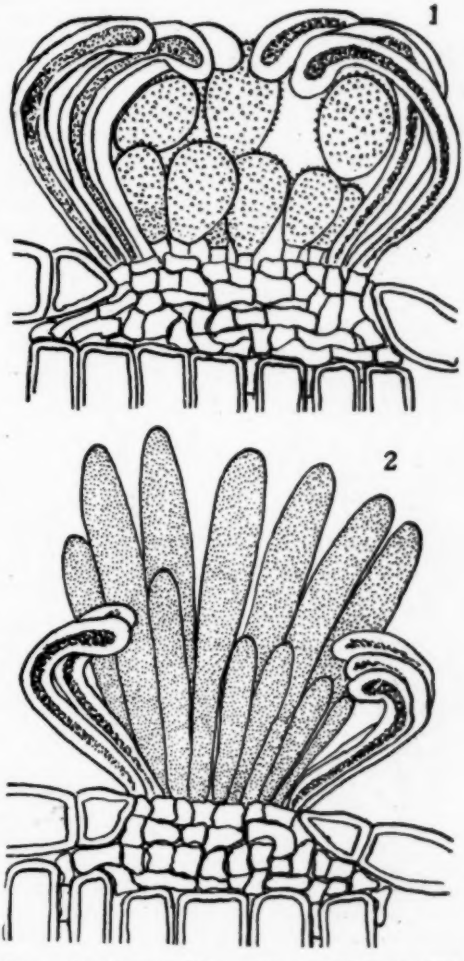

FIG. 1. Uredium × 750. FIG. 2. Telium × 1000.

which would throw light on the identity of the rust and help in elucidation of its life cycle.

Collections of rusted leaves made near Bangalore by middle of March, first gave the indication of a few teliospores developing within the uredia. Further collections made in early April, at a time when the trees were getting defoliated rapidly indicated the abundance of telial development. The teliospores are formed either intermixed with the uredia or produced in separate sori. Macroscopically they are indistinguishable from the uredia, as they have the same golden-yellow colour. This probably explains the telia being overlooked for so many years.

The telia are subepidermal, golden-yellow, and have the same sorus structure as the uredia. In their formation, strands of hyphæ are first grouped in the substomal space. The guard cells are pushed apart widely, and the plectenchymatic mass of hyphæ protrude above the epidermis and form the sorus. The paraphyses are marginal, cylindric, incurved, free at the apex and coalescent at the base. They have orange-yellow contents. The teliospores are cylindric to fusiform, thin walled and sessile. They are produced in clusters on laterally free sporogenous basal cells. In early stages the telia are covered by the marginal, incurved paraphyses which later on due to teliospore elongation and germination are pushed apart and can be seen only at the base (Fig. 2). The teliospores germinate immediately at maturity developing a long four-septate promycelium, bearing globular sporidia on sterigmata (Fig. 3).

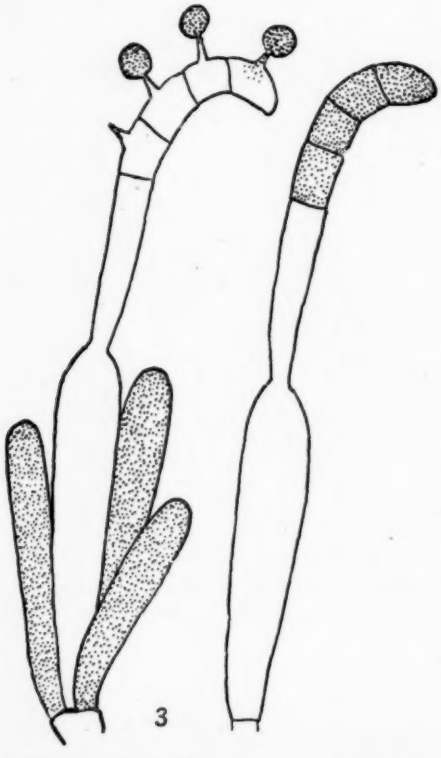

FIG. 3. Germinating teliospores × 1250.

As regards the identity of the rust, the structure of the uredia and telia indicate relationship to *Olivea* Arth. The genus *Olivea* proposed by Arthur[1] with *O. capituliformis* (Henn) Arth., as type, includes three species of which *O. Petitiae* Arth., and *O. Scitula* Syd., occur on Verbenaceous hosts. Arthur described all the spore forms as being subcuticular, but Dietel[3] contested that the uredia and telia are subepidermal. A careful examination by the writer of *O. capituliformis* deposited in Arthur Herbarium, Purdue University (F 2175) confirmed the findings of Mains[4]. The compact masses of mycelia are grouped in the substomal space, and the urediosori and teliosori are first subepidermal and later formed above the epidermal surface. They appear therefore superficial, and are similar in the type of development, to *Crossopsora zizyphi*[5] (Syd. and Butler) Syd., and species of *Prospodium*[2]. The uredia and telia of the teak leaf rust have the same sorus structure and are surrounded by incurved paraphyses which are yellow in the early stages on account of orange-yellow contents but appear hyaline later on. The occurrence of coloured, incurved paraphyses forming a nest-like structure is characteristic of *Olivea capituliformis*. In the teak leaf rust, the paraphyses while having the same general structure are not so prominently developed to give a nest-like appearance. The genus *Tegillium* described by Mains[4] for a rust on *Vitex* closely resembles *Olivea* but differs in having subcuticular telia. Discovery of the telia for the teak leaf rust indicates that it is a species of Olivea, with the following characters:

Olivea Tectonae (Racib.) Thirum. comb nov.
Uredo Tectonae Racib.

Uredia hypophyllous, subepidermal, developing sori above epidermis, orange-yellow, erumpent, and pulverulent, paraphysate;

paraphyses marginal, cylindric, incurved, coalescent at the base with orange-yellow contents, wall upto 2.5 μ thick, swollen at the tip; urediospores orange-yellow, ovate-ellipsoid, densely echinulate, $20 - 27 \times 16 - 22\ \mu$ with indistinct germ pores.

Telia developed within the uredia, or separately, subepidermal, developing sori above epidermis orange-yellow, paraphysate, paraphyses same as in uredia, covering the sori in early stages, later naked; teliospores clavate, fusoid-clavate, sessile, borne in clusters on basal cells, with orange-yellow contents, $38 - 51 \times 6 - 9\ \mu$, wall hyaline, thin; spores germinating intrasorum at maturity; promycelium external, four-celled, bearing globular sporidia.

Hab. On the leaves of *Tectona grandis*, Bangalore, India 7-4-1949, leg; M. J. Thirumalachar.

M. J. THIRUMALACHAR.

Bangalore, South India.
April 12, 1949.

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THE OPTIMUM pH OF *CLOSTRIDIUM LACTO-ACETOPHILUM*

THE unsuitability of the routine turbidometric method alone has resulted in reporting the "good growth" range for *Cl. lacto-acetophilum* as pH 6·2 to 7·4.[1] Whilst this information is adequate for one interested in further work on this clostridium, it fails to point out the optimum pH and leaves one to guess as to which of the two figures referred to above approaches the optimal value. The difficulty of determining the optimum pH in this instance arises from the fact that the pH of the lactate medium in which this organism is grown goes on increasing as the lactate ion gets decomposed. An attempt was therefore made to determine the optimum pH of this organism by resorting to a combination of methods, *viz.*, measurement of growth and measurement of physiological activity, and the results obtained are reported here.

The experiments were done with *Cl. lacto-acetophilum*, strain No. 3. The basal medium contained the following compounds in grams per 100 *ml.* of distilled water: Sodium lactate, 1·0; yeast autolysate, 0·3; sodium acetate, 0·8; sodium thioglycollate, 0·05; $MgSO_4 . 7H_2O$, 0·01; $(NH_4)_2SO_4$, 0·05; $FeSO_4 . 7H_2O$, 0·002, and $CaSO_4 . 2H_2O$, 0·001. With acid and alkaline phosphates the pH in each tube was adjusted to a different level so as to obtain a range varying from 6·20 to 7·55 within which the optimum was sure to be recorded. The several tubes containing the medium were autoclaved and then each tube was inoculated with 0·1 *ml.* of a 48 hrs. old culture. The tubes were sealed to obtain anaerobic conditions by the use of potassium carbonate-pyrogallol seal and incubated at 37·5° C. after the initial turbidity in each tube was determined by the use of a colorimeter. Growth appearing in the tubes was measured the same way every few hours and after 6 days (when the growth had ceased) the contents of each tube were analyzed for the undecomposed lactate as well as the butyrate formed, the latter being the characteristic product of the organism. The methods adopted for the analyses have been referred to before.[1,2] Table I gives he typical results obtained.

TABLE I

pH	Relative growth	Time in hrs.	Lactate decomposed *m*M/100 *ml.*	Butyrate formed *m*M/100 *ml.*
6·20	1010	98	8·50	4·13
6·50	1367	117	8·70	4·65
6·80	1264	117	8·50	4·65
7·10	996	98	8·41	3·60
7·35	757	94	7·81	3·57
7·55	446	94	7·60	3·27

The results would seem to indicate that from the maximal turbidity view-point (which appeared in 117 hrs.) as well as from the point of view of the decomposition of lactate with consequential formation of butyrate, a pH of 6·5 would approach the optimal for this organism. At the same time, if we take the formation of butyrate alone as the criterion for maximal metabolic activity, then two pH values, *viz.*, 6·5 and 6·8 would appear to be equally suitable. If, on the other hand, we accept the early appearance of "good growth" as our criterion (and this organism grows well in about 48 hours) for the optimal, then 6·8 would appear to be indeed the right pH value; for the turbidometric measurements made after 26 and 46 hours

of incubation (see Table II) gave unmistakable evidence in favour of this conclusion.

TABLE II

pH	Relative growth	
	26 hrs.	46 hrs.
6·50	482	969
6·80	617	996

From the above considerations it is abundantly clear that the optimum pH of *Cl. lacto-acetophilum* is 6·8, or a point exactly midway between the "good growth" range of 6·2 and 7·4.

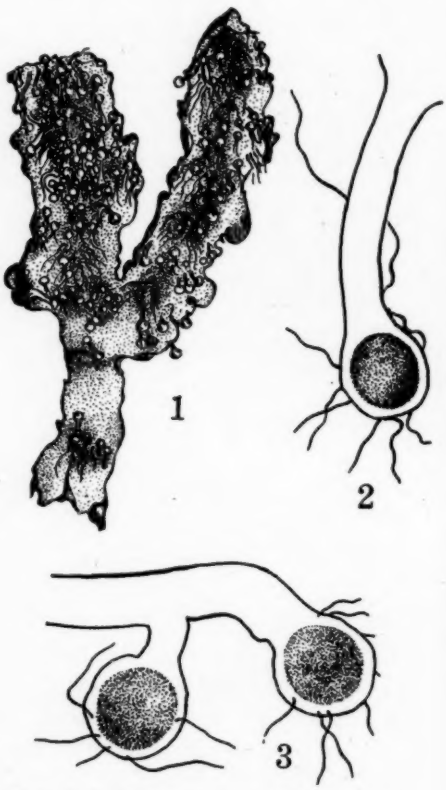
Microbiology Department, J. V. BHAT.
St. Xavier's College,
Bombay,
April 7, 1949.

1. Bhat, J. V., and Barker, H. A., *J. Bact.*, 1947, **54**, 381-391. —, *Ibid.*, 1948, **56**, 777-79.

TUBERS IN A SPECIES OF *ANTHOCEROS*

COLLECTIONS of an *Anthoceros* species made in the Bababudangiris, Mysore, in the month of September 1948, showed that the thalli were dichotomously branched and possessed slender, long, greenish sporophytes, with stomata on their outer walls, and conspicuously elongated epidermal cells. The spores were echinate, purple black in colour and interspersed with elaters. The latter were multiseptate with a hump as in *Anthoceros erectus* Kashyap.

Observations revealed the presence of large numbers of tuberous outgrowths on the undersurface of the thalli, springing from the margin as well as the midrib (Fig. 1). In the initial stages these tuberous structures developed as small cushion-shaped bodies, later being surmounted on a long stalk (Fig. 2); sometimes two such tubers were borne on the same stalk (Fig. 3). The occurrence of such tubers has been reported in *A. dichotomus*, *A. argentinus*, *A. tuberosus* (Goebel,[1] 1905) and *A. himalayensis* (Kashyap,[2] 1929, p. 26). In *A. dichotomus* the tubers stand on the underside of the thallus, mostly on the sterile parts. In *A. argentinus*, on the other hand, partly lateral and partly ventral shoots, darker in colour, become transformed into tubers. In *A. himalayensis* the tubers are generally borne on the sterile plants at the apex, margin, ventral surface, and also on the



FIGS. 1-3. Tubers in an *Anthoceros* sp.
Fig. 1. A thallus showing numerous tubers on the ventral surface. ×3. Figs. 2 and 3 Tubers with stalk. ×45

male and female thalli occasionally. As a rule they are stalked but are found embedded sometimes in the thallus.

Microscopic examination of the tubers revealed the following structural details (Fig. 4). The central core of cells were orange yellow and filled with oil globules. The outer enveloping layers were composed of two to three layers of hyaline cells. Some of these outer cells elongated into unicellular rhizoids. These were also seen to arise from the outer cells of the stalk, especially at their point of origin. Goebel (1905) reported similar cases of development of rhizoids in *A. dichotomus*.

Since viable material was not available

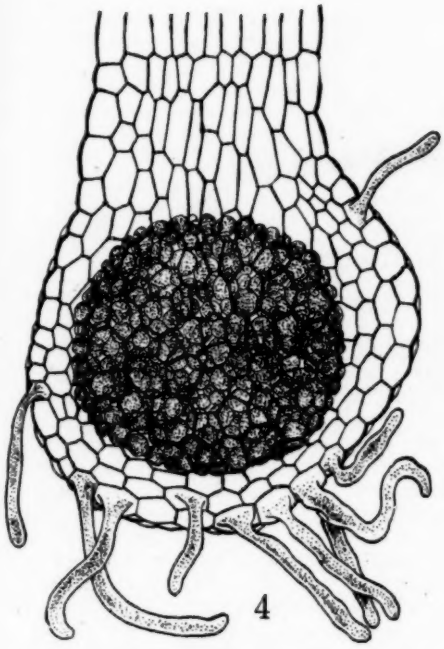


FIG. 4. Tubers in an *Anthoceros* sp. A tuber magnified to show the lighter contents of the cortical cells and the translucent storage cells in the centre and the rhizoids. ×196.

germination experiments were not carried out in the present study to further elucidate the nature of the tubers. Goebel (1905) suggested that they may be of the nature of vegetative reproductive structures. He further regarded them as being transformed branches of the thallus whose ends have become swollen and filled with reserve food materials. So far as our present observations go we are inclined to accept this view of Goebel.

The writers wish to thank Dr. L. N. Rao, Bangalore, and Dr. T. S. Mahabalé of Bombay, for valuable suggestions.

Dept. of Botany, Central College, Bangalore, *December* 21, 1948.

K. SUBRAMANYAM.
B. A. RAZI.

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TWO ECTOPARASITES OF THE BAT *ROUSETTUS LESCHENAULTI* DESM.

DURING our studies on bats in the island of Bombay, we came across a number of ectoparasites which are being studied here. Of particular interest were two Nycteribiids and Streblids (Diptera) which do not seem to have received enough attention in the past.

Phillips[5] recorded some wingless Nycteribiids from frugivorous bats of Ceylon, but he did not get any Streblids. Thompson[6] also recorded a number of these parasites from bats in India. MacCann[4] has reported both these families from bats in and around Bombay and our results confirm his observations.

The anatomy of these interesting parasites has been worked out largely by Jobling[1,2,3]. Very little work in this direction has, however, been done in India on these insects. The anatomy of these parasites is being studied here and the interesting results will be published elsewhere.

These two insects have been identified to be *Eucampsipoda hyrtli* Kolenati and *Nycteribosca gigantica* Speiser. They were collected from the wing membrane and the neck region of *Rousettus*.

Apart from the well-developed piercing mouth parts, there is a well-developed antennal gland with a number of branches. The thoracic segments, though varying in size, are heavily padded with stiff bristles. The legs have sensitive pads on the last tarsal joint, followed by a sharp bent claw. The appendages are so adapted that they could be tucked below the body in times of need. The first abdominal segment bears comb-shaped ctenidia. The end segments are telescoped. The entire body is padded with stiff bristles and also a coat of thin hairs. The shape and locomotion are a perfect adaptation to the ectoparasitic mode of life.

We are thankful to the authorities of the Zoological Survey of India for identification of the parasites and to Dr. P. J. Deoras for valuable suggestions.

Department of Zoology, Royal Institute of Science, Bombay, *April* 17, 1949.

D. V. BAL.
F. AHMED.

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A NEW PLOUGH FOR INDIAN CULTIVATORS

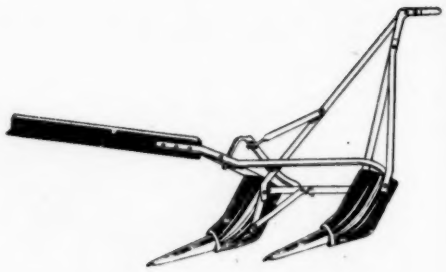
A NEW plough, which may well go a long way to solving the important function of timely cultivation in the field of agriculture has been designed by the Agricultural Engineering Division of the Indian Agricultural Research Institute, New Delhi.

In the course of experimental work it was discovered that the draught of two similar country ploughs coupled together in a certain way fell considerably short of that required for a single plough of the same design. As a result of this factor it was immediately decided to investigate the possibility of designing a double Desi plough capable of operation by a single average pair of bullocks.

The new plough as finally designed is simple in construction and consists of the bottoms only of standard Desi ploughs, suitably coupled together by means of an angle iron frame work and pulled by a single central beam. The ploughs are so spaced in relation to each other that identical furrows are cut and carry out in one operation similar work as would be performed in two operations by a single standard plough.

This new plough is comparatively light, its weight being approximately 50% heavier than a single plough; thus an average ploughman can easily lift and carry it as required for ordinary operational purposes. The draft is, as already stated, tolerable, as instanced by trials in hand dry land, ploughing 4½"—5" deep, and using local Delhi plough bottoms the draft did not exceed 260 lbs. The draft of a single similar plough under identical conditions was 155 lbs. It may be of interest to note that the draft of a single 'VICTORY' bullock drawn soil inverting plough under average conditions varies between 320—400 lbs.

The merits of the new plough are obvious. Bullocks, in many instances and so far as ploughing is concerned are underloaded and based on observations made on bullocks when operating 'Victory' plough and single Desi plough there is considered little doubt that this plough is capable of being operated by a single pair over considerable area in this country without undue extra effort and its daily output will be practically double. Taking an extreme where due either to soil conditions or



capacity of bullocks it is only possible to operate for 3 or 4 hours instead of 6 or 8, that is for only half of the usual daily working period, the out-turn of work will be similar as for a full day and the cultivator given extra time for relaxation or alternative work. In the case of a further extreme when soil conditions make the operation of the new plough impossible, this could be done as before with a single plough and subsequent second and third operations done in half the time with the new plough.

Quality and regularity of ploughing must automatically be improved.

Seasoned ploughmen who have used the new plough are enthusiastic about it and state that in operation it is easier and less tiresome to handle due to it 'stableness' when in work or simply—it works itself.

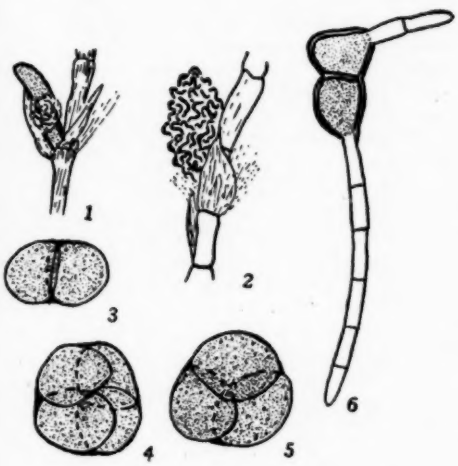
When in production it is estimated that its cost will not exceed, that of a single plough by more than 50%. Thus it will be cheap. It is simple in construction and easily repaired or even constructed by the village blacksmith or carpenter and may well prove to be of great value in the effort being made to-day to increase food production and at the same time ease and improve the work of the Indian cultivator.

I.A.R.I., D. T. BROWN.
New Delhi,
April 20, 1949.

CEREBELLA ON SUGARCANE

DURING the course of taxonomic studies of the sugarcane flower in the material collected in Hebbal, Bangalore, large numbers of spikelets were seen parasitised by a *Claviceps* species, which was similar to that reported by Thirumalachar[2] from Mysore.

A *Cerebella* species closely agreeing with the descriptions of *Cerebella andropogonis* Ceasti. was found to inhabit sceloritial development of *Claviceps* on sugarcane and convert them into greenish-black cerebriform stromata (Figs. 1 & 2). The conidia (Figs. 3, 4 & 5) of the *Cerebella* were present in large numbers.



FIGS. 1 & 2. Showing the *Cerebella* on ergotised spikelets (× 5 & × 7 respectively).
FIGS. 3, 4 & 5. Conidia. × 1800.
FIG. 6. Germination of conidium. × 1,800.

Langdon[1] gives a good discussive account of the biologic status and use of *Cerebella* species studied by him in Australia. Even so in the present study, the *Cerebella* was noticed to be making saprophytic growth on the spahacial stage of the sugarcane ergot, partially suppressing the scelorotial stage that would follow in normal development. Venkatarayan[3] reports the presence of a sooty mould inciting the folded, cerebriform type of development in the ergotised spikelet of sugarcane in Mysore. The fungus which was identified by him as *Coniothecium* species may be only *Cerebella*. The presence of *Cerebella* is a good field indicator of the ergot.

The conidia of *Cerebella* readily germinated in water developing septate germ tubes (Fig. 6). The fungus was not grown in pure culture, but Langdon[1] reports dark cerebriform stromatic growth of the fungus on potato-dextrose agar.

Grateful thanks are due to Prof. P. H. Rama Reddy for kind guidance and encouragement and to Dr. M. J. Thirumalachar for valuable suggestions.

Agricultural College, H. C. GOVINDU.
Hebbal, Bangalore.

March 16, 1949.

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NOTE ON A "SCHORLITE-PENNINITE" ROCK FROM SHIMOGA DISTRICT, MYSORE STATE

DURING the course of a visit to some parts of Shimoga district, an interesting variety of Tourmaline-Chlorite rock has been noticed at Kagehalla dam site near the sixth mile stone along Bhadravati-Chennagiri road. On detailed examination the Tourmaline is seen to be Schorlite, and the chlorite, Penninite. Further, since it showed an interesting mode of occurrence a detailed mineralogical study of the rock has been made.

The P.W.D. channel section from the dam site reveals the relationship of the rock types of the area. At the fourth furlong of the fourth mile, the country rock—namely serpentinised Dunites (ultra-basic member of the Dharwars) are seen enclosing lenticular xenoliths of Hornblende Schist of various sizes. A large number of pegmatite veins of the associated Shimoga granites are also seen showing intrusive relationship with these Serpentinised rocks. It is along the contact of these Pegmatities and the serpentinised rock that the Schorlite-Penninite rock has been noticed. It has developed in a vertical zone parallel to the pegmatities and invariably bordering them oftentimes showing a width of a foot or two, like dark felted masses.

The rock is brittle, compact, fairly hard, heavy, with a specific gravity of 3·2. It is made up of coal black Schorlite and pale green Penninite. Schorlite constitutes the major bulk of the rock occurring in radiating and sheaf-like aggregations of rods and needles varying from 0·1 cm. to 1 to 1·5 cm. in length and 0·1 cm. to 0·3 cm. in width. Penninite occurs as fibrous aggregates in between Schorlite crystals.

Under the microscope, the rock shows only Schorlite and Penninite without any grains of Quartz or scales of Mica. Schorlite

appears as intensely Dichroic transversely cracked prisms and intense blue polygonal or rounded isotropic plates, representing basal sections, containing irreglar black inclusions of various sizes. Pale green to colourless Penninite occurs as fibrous, fan-shaped or pluxy aggregations in between the Schorlite crystals often containing brownish small irregular inclusions. Generally the prismatic sections and sometimes the basal sections of Schorlite show peculiar sieve-like intergrowth structure with Penninite.

The Schorlite and Penninite show the following optical characters.

SCHORLITE

$\omega = 1{\cdot}665.$ $\varepsilon = 1{\cdot}625$
$\omega - \varepsilon = 0{\cdot}040$
$\omega =$ Intense or Prussian blue
$\varepsilon =$ Pale pink to colourless.
Absorption $\omega > \varepsilon$
Elongation — ive
Sign — ive

PENNINITE

(+) X = Y = Pale Green
Z = Colourless
Absorption X = Y > Z
Elongation — ive
Nm 1·585
Ng — Np 0·000
Ultra-blue interference colour.
Passes off from almost Uniaxial to Biaxial.

This Schorlite differs from those described by Winchell[1] Jewall, J. Class[2], W. F. Jenkins[3] and Pichamuthu[4] in its maximum birefringence and distinct Dichroism, and may belong either to Dravite-Schorlite or Schorlite-Elbaite series. With reference to refringence, birefringence and Dichroism it may be inferred that in either case it will belong mostly to the Schorlite end. A chemical or an arc spectrum analysis may substantiate the inference.

The Penninite closely resembles in its optical characters with the description given by Winchell[5], and plotted on the diagram suggested by him for chlorite minerals[6], yields $(At + Dn)_4$, $(FeAnt + Dn)_{17}(Ant + FeAnt)_{58}$ $(Ant + At)_{83}$ which closely corresponds with the range for Penninite given by him $(At + Dn)_{20-40}(FeAnt + Dn)_{0-20}(Ant + FeAnt)_{80-60}(Ant + At)_{100-80}$ when resolved in terms of tne end members of the Chlorite system, Amesite = 34·86%. Antigorite 48.14%. Daphnite 7.14%. and Ferro–Antigorite 9.86%. Total 100·00%.

Since the rock is an unusually interesting type, further studies are in progress and a fuller paper will be published elsewhere.

C. GUNDU RAO.

Dept. of Geology,
Central College,
Bangalore.
May 4, 1949.

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COURSES ON INDIAN PHILOSOPHY AT ASIA INSTITUTE IN NEW YORK

PROFESSOR P. T. RAJU, of the Department of Philosopohy of Andhra University, South India, will offer a seminar in Indian philosophy for graduate students and a general course on contemporary Indian philosophy at the Asia Institute in New York, beginning October this year. The professorship has been made possible for one year through a special grant of funds from the Tata Trust of Bombay. This is the first of visiting professorships to be set up under the Trust.

The Asia Institute maintains a school for Asiatic Studies accredited by the University of the State of New York, and a public museum of Oriental arts and crafts, and sponsors special events for its membership.

The Institute recently announced acquisition of a 500-volume library on Indian art, formerly the property of Dr. Heinrich Zimmer, an authorirty on Indian art, myth, and religion, who died in 1942. Addition of the Zimmer Library brings the Institute's collection of books and journals on Asia to about 30,000.

REVIEWS

Trace Elements in Food. By G. W. Monier-Williams. (Chapman & Hall Ltd., London), 1949. Pp. viii + 511. Price 30 *sh.* nett.

Remarkable developments have taken place, in recent years, in canning and dehydration of meat, fruits and vegetables with the result that one meets with a wide variety of processed foods for daily consumption. Contamination of food with certain trace elements is, therefore, inevitable under these conditions and consequently there is a great need for adequate knowledge of this subject. In this book, the author has collected all the available information on twenty nine trace elements which enter into our dietary in one way or another. He has dealt exhaustively on the biochemistry, nutritional significance and toxicology of every one of them with extensive references to original publications.

A large volume of literature has accumulated with regard to copper, zinc, iron, manganese iodine and cobalt, owing to their nutritional importance and the author has reviewed the work done on these elements in great detail. A good many of the trace elements like boron, molybdenum, selenium, lead, tin and nickel have been described with particular reference to their bearing on plant and animal life and to the diverse ways in which they gain access to food through manufacturing processes or commercial practices. The author also discusses the upper limits of concentration of these elements in foods and the existing laws with regard to their toxic levels.

For every trace element, several methods of determination have been outlined and their relative merits discussed. Most of these are colorimetric in nature and involve the use of organic reagents; gravimetric, polarographic and spectrographic methods have also been described for many of the elements. While a "general method" has been given for estimation of copper, one finds no such method of choice described in the case of other elements. This is rather unfortunate since most analytical and food control laboratories, which cannot afford a polarograph or a spectrograph would welcome from so experienced an author, one recommended method in detail, which can be easily applied for routine determinations. Besides for the sake of completeness, mention should be made of the microbiological methods recently developed for the estimation of elements like manganese and the use of radioactive isotopes in the assay of some of the trace elements.

The following additional information may be included in the book to increase its usefulness and make it an excellent volume of reference on trace elements. The importance of cobalt as an essential constituent of crystalline vitamin B_{12} the most effective anti-pernicious anæmia factor, recently isolated needs mention. Studies carried out with radioactive isotopes of iron, copper cobalt, manganese, zinc and iodine with special reference to their deposition in bones and other parts of the body deserve detailed comment. A table, in which the limits of toxicity for every one of the trade elements and the physiological requirements of some of them, if given, will be very helpful for ready reference. Similarly, since dithizone (diphenylthiocarbazone) has been employed in the estimation of many trace elements, it will be advantageous to include towards the end of the book, a tabular statement of the different conditions under which these elements can be determined by this reagent and the manner in which interfering substances eliminated.

The book on the whole is quite comprehensive and will prove invaluable to the food chemist, public health analyst and others interested in trace elements in food.

P. S. SARMA.

Summary of "Some Aspects of Television". By L. H. Bedford, O.B.E., M.A., B.Sc., M.I.E.E., of Marconi's Research Laboratories. Cantor Lecture on Television delivered on Monday, 22nd November 1948. Published in the Journal of the Royal Society of Arts, Vol. XCVII, No. 4788, 11th February 1949. Pp. 180-194.

A general approach to the problem of television reveals that to reduce the multichannel information implied in visual information to a form suitable for single channel communication is one of the two major problems in television. The other one is the signal to noise ratio. A lens is capable of imaging a finite scene made up of a large number of points. Human eye is the best lens ever made. If we take the case of an average cinema picture which subtends $14° \times 17{\cdot}5°$ at the eye, the maximum number of picture points with which we can usefully concern ourselves is 880,000.

Projected definition of an average cinema picture is of the order of 500,000 picture points. The British Television Service provides an effective definition of 82,500 picture points.

The transmission of visual intelligence was first made possible in 1883 due to the introduction of the idea of scanning by Nipkow. The principle is to substitute a large number of channels of low bandwidths by a single channel of wide bandwidth. This is done by successive glimpsing of the intelligence of the picture points scanned in some specific order. Modern methods of scanning are very much improved but the principle remains unaltered.

After briefly describing the older methods of analysing and synthesising a picture the author refers to the question of optimum number of lines for an assigned frequency band and points out that the older relation $F = \frac{1}{2} s^2 r . \frac{1}{T}$ where s indicates number of scanning lines, r the aspect ratio and T the complete repetition period or frame period should be replaced by a modified relation $F_a = 0{\cdot}75 \cdot \frac{1}{2} s_o^2 r \cdot \frac{1}{T}$ between an assigned frequency F_a and the optimum number of interlaced scanning lines s_o.

In the older method of scanning, the transmitting tube (analyser) provides a highly mobile light spot (of constant intensity) and a fixed photocell receives light from all points of the picture. The reciprocal arrangement of a fixed light source illuminating the whole picture and a flying punctiform photocell is made use of in Farnsworth Image Dissector. In Farnsworth Image Dissector the scene is imaged on the cathode of a photocell and the emitted photoelectrons are imaged by a magnetic field to form an electron current image which is bodily scanned past an aperture of picture point size by means of transverse magnetic fields. The electron current through the aperture constitutes the signal current.

Considering the second fundamental problem that of noise to signal ratio, we find that when this ratio is one per cent. the noise can be regarded as evanescent. In this case, the signal current should be at least equal to 10 $m\mu A$ when F is equal to 3 megacycles. To get this signal current from a photocell, illumination of 7,300 lux is required. This means that the Farnsworth Image Dissector can be used only as a camera tube for outdoor lighting condition.

An improved sensitivity has been realised in Iconoscope by Zworykin. In the Farnsworth Image dissector, the photo current is effective only during a short portion of the cycle in which the photo current element scans the aperture. All the rest of the photo current is wasted. But if the whole of the photoemission of the individual picture points during the frame period are stored and utilised at the time of scanning the signal to noise ratio can be very much improved. The principle of "Storage" utilised in the iconoscope has improved the sensitivity of camera tube considerably. It has been shown in Appendix 2 that in the case of non-storage method the required illumination increases with the fourth power of the number of lines while in the storage method it increases only with the square of the number of lines. In case of iconoscope illumination required varies from 20,000 to 2,000 lux depending on the efficiency of photocathode and on the depth of focus required.

The next stage of improvement is the image iconoscope in which a stage of gain is inserted prior to the scanning process. This leads to the improvement in sensitivity with this tube by a factor of about ten. Both these types of iconoscope suffer from the trouble of spurious signals due to secondary emission, This trouble known as shading has been eliminated in the Orthicon tube introduced in 1940 by Iams and Rose. This tube also has become the victim of obsolescence with the development of a more advanced type of camera tube, the image orthicon. This tube owes its success due to the combination of the following principles.

(*i*) Gain stage prior to scanning by use of electron image and secondary emission, (*ii*) use of two sided target, (*iii*) use of orthicon principle of low voltage scanning and (*iv*) use of electron multiplication of signal current. The noise to signal ratio in image iconoscope is higher than one per cent. The higher noise level is due to inefficient beam modulation at low light levels.

In conclusion, it may be said that there is as yet no perfect camera tube. All types have their various merits and limitations although the present tendencies in U.S.A. suggest the ultimate replacement of all other types by image orthicon tube.

S. K. C.

Rhenium. By J. G. F. Druce. (Cambridge University Press), 1948. Pp. 99. Price 10 *Sh.* 6 *d.*

The enunciation of the periodic law by Mendelief in 1869 and the fulfilment of his predictions to the minutest details by the discovery of scandium, gallium and germanium,

set many chemists all over the world, in search of the new elements to fill up the gaps in the periodic table. The discovery of Mosley's Law of atomic numbers in 1914, gave a further incentive to look for the missing trace elements. Rhenium has a thrilling history, since its discovery was announced almost simultaneously by three sets of investigators working on various minerals in different laboratories. In June 1925 Noddack and Tacke from Germany announced their discovery of the new element by the X-ray examination of the concentrates derived from platinum and columbite ores and named the new element as Rhenium after Rheinland. During October of the same year Druce announced that the new element was found in the concentrates of manganese minerals when the manganese was precipitated as sulphide. The wavelengths of the X-ray spectrum obtained by Druce were identical with those of Noddack and Tacke and the name Rhenium was accepted. During November, Dolejsek and Heyrousky obtained polarographic curves for rhenium in manganese sulphate solutions and confirmed the presence of the element in the preparation of Druce. A prolonged controversy then followed regarding the priority of the discovery. Prandtt denied the occurrence of rhenium in columbite, while Russian men of science (Zvjagintsev and others) were unable to detect the presence of rhenium in native platinum. The work of Druce and Heyrousky was also criticised for want of accuracy.

Whatever the claims for priority may be, there is no doubt that Druce has been one of the pioneers in the field of research work on rhenium and its compounds. Coming from him, the book gives an authoritative first-hand and uptodate information about the chemistry of rhenium and its compounds. It is very gratifying to note that references are given even to publications appearing in 1946. The book is divided into eight chapters, the first giving an introduction including the historical aspect, the second describing the isolation and properties of rhenium. The preparation and properties of the oxides, acids, halides, sulphides selenides and thio-salts form the subject matter of Chapters III to VI. The organic derivatives of rhenium and the applications of rhenium are described in Chapters VII and VIII respectively. The book makes an interesting reading, with the author's experience in various experimental procedure. The book will be of immense value not only to the students of advanced inorganic chemistry but also to those that are doing research work on rhenium.

M. R. A.

Elasticity of Wood and Plywood. By R. F. S. Hearmon. (Forest Products Research Special Report No. 7. Dept. of Sci. and Ind. Res. London), 1949. Pp. 87. Price 2 *Sh.* net.

In his valuable report Hearmon gives the results of his extensive experimental investigations along with the relevant theory and experimental results of other workers in the field. A fairly comprehensive bibliography at the end adds in no small measure to the value of the report. Such a presentation greatly aids the appreciation of the value and extent of the author's investigation in the correct perspective of existing knowledge and useful lines of further development. The nature of the subject of investigation is such as to preclude any but a very approximate agreement between theory and experiment. The application of the strict mathematical theory of elasticity developed for a homogeneous material with a definite molecular structure to a material like wood or plywood consisting as it does of a heterogeneous conglomerate of different molecular varieties subject to random variations due to fluctuations of growth conditions, takes one far into the realm of extrapolation of exact knowledge.

A few salient points in the report are worth mentioning. Hearmon reports that in going from the static method to a dynamic method of frequency about four cycles per second, the elasticity shows a rise of about 20%, while there is no further change as the frequency goes up to even 10,000 cycles per second. Even though the theoretical expression for the dynamic modulus does not contain a dispersion term, it is however well known that in the case of metals there is a definite rise in elasticity as the frequency rises from a low mechanical vibration to a sonic or ultra-sonic frequency. In studying variation with temperature, Hearmon recommends and has adopted a dynamic method. The very poor thermal conductivity of wood would greatly mitigate against thermal equilibrium being established even in slow oscillations. A good static method with a good thermo-static control of temperature and plenty of time allowed between loading and observation is more likely to yield a correct picture of temperature variation of elasticity. It would have been better if, in deriving equations 19 and 20, terms for the glue layers had been explicitly included. It is interesting to

note that the elasticity of plywood is greater in bending or compression according as the grain of the faceplies is parallel or perpendicular to the length of the specimen. The work on the buckling of plywood plates and tubes is of great practical utility. On the whole, the extension of the author's work to Indian timbers will be of very great practical interest especially at this time when the nation's air sense is rapidly expanding and its forest resources are being systematically investigated.

P. S. S.

A Textbook of Bacteriology. By N. G. Pandalai, M.D., D.T.M., F.R.C.P., Professor of Bacteriology and Principal, Andhra Medical College, Vizagapatam. (Bangalore Printing & Publishing Co., Ltd., Bangalore City), 1948. Price Rs. 18. Pp. i-viii+748.

As there are very few books on medical and allied literature by authors with experience of Indian conditions this book on bacteriology by Dr. Pandalai is a welcome addition to the literature on the subject. Dr. Pandalai has been associated with the teaching of bacteriology at the Andhra Medical College for over 20 years. Very few can claim to have had such unique opportunities to know the requirements of students. In addition, he has had large experience in clinical bacteriology in the college hospital and thus is eminently qualified for being the author of this book.

After giving a description of bacteria in general, the author has given a detailed discourse on the physiology of bacterial cell. It is obvious that this knowledge is essential to have a rational understanding of the behaviour of bacteria. A chapter has been devoted to the mechanism, care and use of the microscope. The sterilisation of bacteria by various agents, physical and chemical, has been fully described. The author has exhaustively discussed the subjects of infection and immunity in the light of recent developments of biochemical investigations. The specific pathogenic bacteria are described in detail, in separate sections. Human ricketsia, filterable viruses and human virus diseases are also included. Although protozoa do not come under bacteriology a chapter on the subject, essentially of pathogenic importance to man such as plasmodium malaria, trypanosome and lieshmania, etc., would have been of immense help to students. The subjects of antibiotics and chemotherapy have also received attention. To make the book complete and comprehensive, even for the students of public health, a chapter on the bacteriology of water and milk has been included. But one might feel disappointed that no figures for the bacteriological standard for potable water for India or for other tropical condition have been given, although Madras has enjoyed a reputation for pioneer work in this field and a large volume of information on the subject is available. Incorporation of such local information should enhance the usefulness of a book of this kind. One glaring defect to which the author has made apologetic reference in the preface is the absence of proper illustration, the importance of which in a textbook of this kind is obvious. It is hoped that an early revision will rectify all these defects. On the whole the book is a worthy contribution to the medical literature of Indian authorship and is commended to the students and members of the profession.

On the publisher's side, there is room for improvement in the quality of the paper and printing.

K. P. MENON.

Survey of India Technical Report 1947—Part III Geodetic Work. (Compiled at the Survey Research Institute and Printed at the office of the Geodetic Branch Survey of India, Dehra Dun, 1948, Price Rs. 4).

Geodetic work in India had been going on at a very low ebb since 1931 owing to financial stringency, and was almost at a stand still for some time after the beginning of World War II. However, owing to the necessity for solving geodetic problems connected with the War effort, a Survey Research Institute was organised in 1943, and this Institute is being continued as a permanent organization since December 1946. A good deal of useful work has been carried out by the Institute in 1947.

The report under reiew presents in seven chapters a comprehensive account of all the information which had accumulated from 1939 to 1947. The data concerning a continuous chain of Triangulation from Syria to Malaya have been presented. The possibilities of connecting the Triangulation through Sumatra and Java to Australia and Phillipines in the East, have been pointed out. The data concerning the Persian Triangulation connecting the Indian Primary and the Iraq Primary systems have been presented, and the problems of Indo-European connection have been discussed. The discrepancies at junctions of various countries are pointed out. The maps of each country are gridded with respect to its own

sphericals, and when boundaries are crossed, the maps may be out of sympathy with those of the adjoining country. The adoption of a suitable spheroid like the International, in India, is said to involve republishing all our trignometric data and a shift of the details which means a collosal and expensive undertaking. It is suggested in the Report that the two differing series of maps may have a certain area of overlap, amounting to one sheet depth, on either side of the junction line, and that the two sets of maps should indicate the discrepancies by suitable marginal notes.

High Precision Levelling data in India are presented in Chapter II. The succeeding Chapter on the measurement of Gravity, furnishes a brief description of the Frost Gravimeter which is now being used by the Survey of India. The results of the trial observations taken with this instrument near Dehra Dun are recorded. The future programme of providing a close 10 mile net work of gravity stations using this instrument, is outlined. The existing 70-mile grid has been based on pendulum observations which are far inferior in sensitivity when compared to those obtainable with the modern Gravimeters. The proposed Gravimeter Surveys on a close net work of stations may be expected to yield many interesting details of the nature of the earth's crust in this part of the World. Moreover, these stations will serve as bench marks for detailed local geophysical prospecting in the exploration for minerals and oil in certain parts of the country. Magnetic Variometer measurements are also proposed to be combined with the Gravimeter measurements on this close net work of stations—thus adding to the value of these geophysical observations for geologic interpretations. The Report mentions that such gravimeter and magnetic surveys are already in progress in the Raniganj coal field area in Bengal and near Nagpur in C.P. The results of these measurements which are promised to be published in the next Technical Report will be watched with great interest particularly by geophysicists, geologists and those connected with the mining industry.

The data obtained on the Deviations of the Vertical have been discussed in Chapter IV. In particular, the Charts of the Geoid in India and neighbouring countries have brought together all the data collected upto 1947. One of the interesting features observed deserve to be mentioned here: while the geoid in Peninsular India displays humps of the order of 30 feet above the International Spheroid, its rise in Burma is 110 feet, in a distance of only 1,000 miles,—which is regarded as phenomenal and without parallel anywhere else in the world.

The observed deflections in the plumbline in India are usually said to be independent of the major visible features, indicating that there are equally important hidden features at work. The plumb line deviations connected with the Himalayan Range are well known. From the results obtained recently in the Kulu valley, it is stated that the geoid rises from south to north in that region, and also that evidence is accumulating that the geoid in the main goes with topography. So the opinions expressed previously to the effect that the geoid would be found to be depressed under the Himalayas, because the mountain range is constituted of sedimentary rocks, appear to be incorrect. Such measurements however, ought to be extended over a larger area and in a closer net work of stations, before these inferences can command a general acceptance.

The work carried out by the computing office at Dehra Dun is outlined in Chater V. An account of the Tidal observations and inspection of the Tidal observatories, is given in Chapter VI. The results of the routine, and research work carried out in the Observatories of the Survey of India are presented in Chapter VII. The causes which led to the closing down of the Magnetic Observatory at Dehra Dun in August 1943 and the attempts that are now being made to start a new station are also given. Finally, the results of the magnetic field work carried out between 1942 and 1947 are presented. Most of these observations were carried out to meet the demand for accurate data on magnetic declinations for maps for military purposes. For lack of proper Observatory control, much of the data then obtained could not be corrected for diurnal variations and perturbations. A magnetic variation chart for Epoch 1946 is also reported to have been compiled.

Mr. B. L. Gulatee, President of the Survey Research Institute, is to be congratulated for promptly re-starting the publication of the Geodetic Reports which had been suspended since 1940.

M. B. R. Rao.

GHEE—ITS PRODUCTION AND MARKETING

THE most striking difference in the dairy industry of this country and that in the West is that a large bulk of liquid milk is consumed in the from of its products. The most important amongst these products is ghee for which nearly 43·4 per cent. of the total available supply of milk, amounting to nearly 4929·2 million gallons is used. This position is due to the fact that the production of milk and ghee are followed largely as a subsidiary occupation as a result of animals which every agriculturist must keep for the tillage of land. Further, amongst the products of milk butterfat is fairly easy to isolate and under normal conditions possesses good keeping quality. Any improvement in the method of manufacture and marketing of such an important product can therefore be expected to be of considerable benefit to the producers. With this object the Central Agricultural Marketing Department* has carried out a comprehensive survey of the methods of manufacture, quantity available, price, methods of assembling, storage, transport and distribution, quality control and legal standards for ghee in India. Those acquainted with the ghee trade will realise that such a survey is beset with many difficulties, and the results can at best be taken to represent the broad outline of the general trend and not literal facts. This is borne out by a study of the figures for utilisation of milk given in the present survey carried out in 1945 and those reported before.† Whereas previously it was stated that 27·3 per cent. of total milk produced is utilised for fluid consumption, 58·0 per cent. for making ghee, and 14·7 per cent. for making other products, the latest publication gives these figures as 35·4, 43·4 and 21·2 per cent., respectively.

The production of ghee is concentrated mainly in the northern and western regions, which account for three-fifths of the total ghee produced. Madras, Mysore and other South Indian States contribute only to the extent of about 13 per cent. of the total Indian production. An idea of the difficulty in marketing this almost an universal item of diet in the country will be had from the fact that the amount of ghee produced per annum per 100 persons varies from 0·4 maunds in Assam to 16·0 maunds in Rajputana, which when worked out on the basis of production per square mile comes to 0·8 maund in Assam and 28·5 maunds in Baroda State, the average for the whole country coming to only 8·9 maunds per square mile. The average *per capita* consumption for the country as a whole comes to a very meagre figure of 2·8 lb. per annum. Only a small portion of the ghee produced is retained by the producers, and the marketable surplus varies from about 20 per cent. in the Punjab to 97 per cent. in Hyderabad. It is also noticed that in places which produce less ghee, the producers tend to dispose off a greater part of their production. As a rule the consumption of ghee in urban areas is much higher than the corresponding rural areas, the only exception being the Punjab where these two figures are almost equal. In Bihar the difference is most marked, the *per capita* consumption in rural areas being 0·6 lb., whereas the corresponding figure for the urban areas is 20 lb. per annum.

Though the basic method for the isolation of ghee is largely the same, namely by churning soured milk and melting the butter, the quality produced shows wide variation. Thus there seems to be much scope for improving the quality of ghee by suitable propaganda. Knowledge about the preparation of good ghee is now available. The process is very simple, the essential things being observance of cleanliness at every stage of preparation, and control of the final temperature of melting butter to obtain ghee with pleasant aroma and good keeping quality. It is possible to obtain good ghee either by the *Deshi* process, or from creamery butter, or by directly heating cream. *Deshi* method tends to give ghee with a more appealing appearance and aroma for reasons not yet fully understood. Though a low yield of butter-fat is obtained by this method it is due more to the unfavourable conditions of churning generally adopted rather than due to any inherent defect in the method. Under ideal conditions a loss of only 7 to 8 per cent. of butterfat occurs, and this loss is not a loss in the trade sense as buttermilk is normally consumed by the producer. Any hasty replacement under village conditions of this traditional method with a view to secure a few more percentage of ghee will result in the loss of a valuable bye-product, namely separated milk, which cannot

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* "Report on the Marketing of Ghee and Other Milk Products in India," Central Agricultural Marketing Deapartment. Govt. of India, 1948, Manager of Publications, Delhi.

† "Report on the Marketing of Milk in India and Burma," Central Agricultural Marketing Dept., p. 67, 1943.

be readily utilised in the same manner as buttermilk.

As things stand to-day a large quantity of inferior quality ghee is put on the market, the two main defects being high amount of free fatty acids and off flavour. The general trade practice is to blend the inferior product with good quality ghee which ultimately results in the lowering of the general quality. In the present legal set of standards prescribed adequate consideration is not given to define quality more scientifically. Bazaar ghee has an established reputation for adulteration and any individual trader trying to sell pure ghee is likely to meet with disappointment in the beginning. This state of affairs could be remedied only by a determined effort by the trade itself. The quantity of ghee produced in the country is very inadequate to meet the nutritional requirements of the population and with the present high price of ghee, only the upper strata of the society can afford to patronise it. It is essential for the trade to grasp this simple fact and give up the vain attempt to compete with cheaper fats. Propaganda on scientific lines is lacking in the country and without any positive proof it is believed by many that ghee is superior to other cheaper vegetable fats and essential in their diet though little is available. A large amount of scientific literature is available on the nutritive value of fats in general and it is rather surprising why our scientists feel so shy to speak out the truth. The report reviewing the extent of adulteration mentions that " in Bombay city alone there are about 40 establishments engaged in the scientific blending of vegetable oil products and genuine ghee". Though adulteration of ghee is widespread this is no doubt an astounding statement especially as it comes from a Government department. It is doubtful if adulteration can be said to be carried out so openly in a big urban centre without attracting the attention of the authorities concerned. A few such hasty statements are noticeable in the report which could have been put in a better way by careful revision.

The report contains at certain places unnecessary details about the method of manufacture which seem entirely out of place in a report on marketing. The same applies to some of the illustrations. Unnecessary paraphrasing, as illustrated by the following comments, could have been avoided:—"The outturn of *rabri* is estimated at 25 to 30 per cent. of milk. Thus 10 seers of milk yield nearly two and a half to three seers of the product" (page 63). The report on the whole makes only a passing reference to the cost of production of various products, a subject on which a survey of this type could be expected to throw considerable light.

The methods commonly followed for handling ghee at the collecting and blending centres leave much to be desired. The whole process is carried out in a crude manner. In fact, it is a wonder that inspite of such rough handling the product retains its marketable quality. The ghee that comes to the market is sold in a rather crude manner. For this reason ghee trade has to meet a keen competition from the vanaspati industry. On account of the doubtful quality of market ghee, vanaspati finds many adherents without much coaxing. For this state of affairs the ghee trade alone is to be blamed, as such a big industry has made no serious attempt to organise and utilise available scientific knowledge that will win the confidence of the consumers.

It is not always easy to define quality quantitatively as ghee varies in composition due to various factors, the most important of which is food. Much of the confusion in quality control is no doubt due to these natural variations. It is, however possible to produce a very nearly uniform product by a judicious adjustment of feed. The present multiple standards prescribed for quality leave much to be desired, and as every analyst is aware serve only to create more complications. A uniform standard for the country as a whole is not only desirable but will greatly simplify the matter, and should not prove difficult to evolve if the subject is approached logically. For this purpose it is suggested that specifications for quality control work should include only the usual orgenoleptic tests, a limit for free fatty acids content, a minimum Reichert value of 24 to 26 (or better corresponding refractive index reading so that much time will be saved in analysis), a negative phytosteryl acetate test, and a minimum value for vitamin A content. Sometimes ghee has the required Reichert value but it is offensive to taste. An insistence on a minimum vitamin A standard will help to safeguard the quality to a great extent. Further, nutritionally there is nothing much to choose between ghee of high or low Reichert value, or between ghee and other cheaper fats, except that ghee is rich in vitamin A. Hence it is logical that there should be a minimum standard for vitamin A content. Even if a low Reichert value of 24 is allowed in order to secure an uniform all-India standard, the genuineness of ghee will be safeguarded by inclusion of the phytosteryl acetate as a routine method. If ghee falls below a certain minimum value for vitamin A it should not be allowed to be sold as ghee.

SCIENCE NOTES AND NEWS

National Institute of Sciences of India

At the meeting of the Council of the National Institute of Sciences of India held at Bangalore on the 6th May, 1949 the following awards of Research Fellowships were made:—

National Institute of Sciences Senior Research Fellowship:

1. U. R. Burman, M.Sc. (Cal.), to work on "Internal Constitution of Stars" at the University of Calcutta.
2. Dr. A. B. Kar, Ph.D. (Edin.), to work on "Endocrinology with special reference to Birds" at the Central Drugs Laboratory, Calcutta.
3. Dr. S. M. Mukherji, D.Sc. (Cal.), Ph.D. (Bir.), to work on "Use of metal-ammonia reduction method in the syntheses of naturally occuring substances and valuable intermediates" at the University of Calcutta.
4. Dr. K. V. Srinath, Ph.D. (Lond.), to work on "Cytology" at the Central College, Bangalore.

National Institute of Sciences Junior Research Fellowship:

1. Miss Ira Bose, M.Sc. (Cal.), to work on "Effect of Ionising Radiations on Grasshopper chromosomes" at the University of Calcutta.
2. Mr. S. Datta Majumdar, M.Sc. (Cal.), to work on "Relativity and Quantum Mechanics" at the University of Calcutta.
3. Dr. S. G. Joshi, Ph.D. (Bom.), to work on "Mineral Nutrition of Plants and Microbial and Biochemical activities in the Soil" at the Fergusson College, Poona.
4. Mr. T. M. Mahadevan, M.A. (Mad.), to work on "Rare Minerals of Madras Presidency—a study" at the Presidency College, Madras.
5. Mr. D. K. Mukherji, M.Sc. (Cal.), Dip. Agri. (Cantab.), to work on "Plant Physiology as applied to Plant Breeding (Embryoculture)" at the Indian Agricultural Research Institute, New Delhi.
6. Mr. K. Subramanyam, M.Sc. (Mysore), to work on "Embryology and Floral Anatomy in some members of Melastomaceæ and Embryology of Lobeliaceæ, Campanulaceæ and Stylidiaceæ with a note on the interrelationship of these families" at the Central College, Bangalore.
7. Mr. B. V. Sukhatame, M.A. (Delhi), to work on the "Theory of certain distribution in Non-parametric tests and its applications" at the Indian Council of Agricultural Research, New Delhi.

Imperial Chemical Industries (India) Research Fellowship:

1. Mr. A. K. Chakravarti, M.Sc. (Cal.), to work on "Cytogenetics on some common fruit trees of India and the application of colchicine to raise improved types" at the University of Calcutta.
2. Dr. A. P. Mahadevan, M.A. (Mad.), B.Sc. Tech. (Bom.), Ph.D. (Lond.), to work on "Studies in the Pterin Field" at the University of Madras.
3. Mr. C. Ramasastry, M.Sc. (Mad.), to work on "Spectroscopy" at the Andhra University.
4. Dr. K. K. Reddi, Ph.D. (Mad.), to work on "Role of anti-thiamine factor in Nutrition" at the Indian Institute of Science, Bangalore.

Zoological Society of India

The annual meeting of the Calcutta Branch of the *Zoological Society of India* was held in the Indian Museum on 20th April 1949.

Condolence resolution was passed on the death of distinguished scientists like Prof. Ram Unni Menon, Prof. Birbal Sahni and Dr. Immes. The Secretary then read the annual report of the branch. New Office-bearers were elected for 1949 as follows:—

Chairman.—Dr. Satya Charan Law, Ph.D.
Secretary.— Mr. Satyendra Prasanna Basu M.Sc., re-elected. Dr. S. P. Ray Chaudhuri of the Zoology Department, Calcutta University, gave a lecture on "Cytology and Systematics".

Dr. Lal C. Verman

Dr. Lal C. Verman, Director, Indian Standards Institution, will be leaving for Paris next month, to attend a conference of the International Organization for Standardization, as the representative of India.

ERRATA

Vol. XVIII, No. 4, April 1949, page 132.
Note on Bond Energy and Ionic Character of Hydrogen and alkali Halides: *for*

$$\Delta i = D(A-B) = (1-i)\sqrt{D(A-A)\cdot D(B-B)}$$

read

$$\Delta i = D(A-B) - (1-i)\sqrt{D(A-A)\cdot D(B-B)}$$

Vol. XVIII, No. 3, March 1949, page 76.
Note on Dielectric Constant of ionic solids: In equation 1 *for* u^2 *read* μ^2.

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